

PC MAGAZINE

**First Looks:
Windows CE
Devices Take
On Palm III**



**Project
Management:
6 Programs
To Keep You
On Track**

**Managed
PCs: 38 Good
Corporate
Citizens**

**Net Tools:
Fast Ethernet
Switches Cut
Congestion**

**OpenGL:
High-End PC
Graphics**

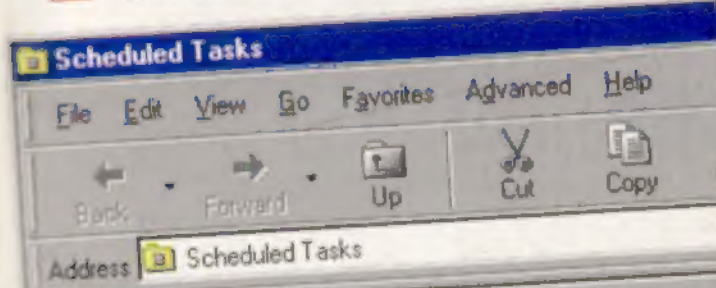
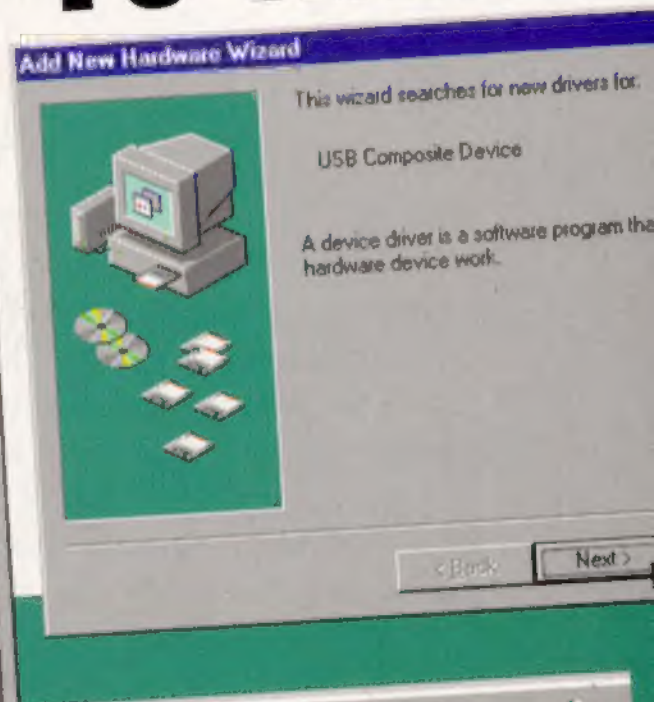
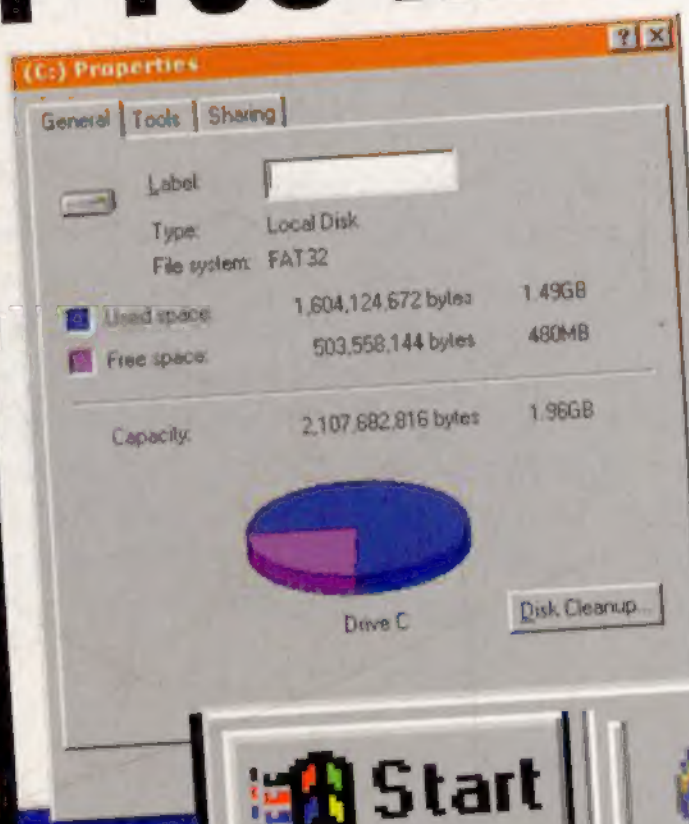
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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOL. 17 NO. 12 JUNE 30, 1998

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Portable Computing Direct Shopper - Mar. 1998

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- PCI Bus Architecture with NeoMagic 128-Bit Graphics Accelerator
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- 32-Bit CardBus and Zoomed Video Support
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A Wall Street Revelation



"There's a little geek in all of us." This was written on the button I was wearing a short while ago, as I accompanied some of my colleagues to the floor of the New York Stock Exchange, surrounded by thousands of traders and billions of dollars' worth of technology. The button was a component of a marketing program that

reports on cable TV.

Different firms have different trading stations, with varying degrees of technological sophistication. All had keyboards and telephones everywhere, although notably the exchange does not allow the use of cellular phones on the trading floor. All of the trading stations were very tight, as space is clearly at a premium, but some stations took advantage of cutting-edge techniques such as using multiple types of displays on movable racks with special lighting.

Ziff-Davis, the parent company of *PC Magazine*, used when it went public a few weeks ago.

As part of going public, the company held a street fair outside the stock exchange. ZD chairman and CEO Eric Hippeau and Masayoshi Son, chairman of Softbank, ZD's largest shareholder, rang the bell that began the day's trading. Many other ZD employees witnessed the festivities.

I was in a group that met on the floor to watch the bell-ringing ceremony. While taking a tour of the stock exchange and its famous Wall Street location, I started thinking about the role of technology in the market and in business in general today. New York Stock Exchange chairman Richard Grasso told us that the more than 3,000 companies traded on the exchange had a combined market capitalization of more than \$12 trillion. On a typical day, he said, more than \$5 billion worth of trades would take place.

He also said the exchange accounts for more than \$5 million in business a minute; therefore, the bell ringing had to be punctual.

Since so much of what it does hinges on efficiency, the stock exchange is a major consumer of technology. Grasso indicated that the stock exchange uses more than \$2.5 billion in technology to track trades and information.

Indeed, the technology is one of the first things you notice on the exchange floor. Monitors of all shapes and sizes are just about everywhere. I've seen a lot of flat-panel displays, but I've never seen so many running so many different applications in one place. It seemed as if there were thousands of TFT panels in front of traders everywhere—some showing stock market results and messages, others showing market

Elsewhere, monitoring stations exist so that exchange officials can monitor the progress of the market and look at pending and completed trades. The goal is to make sure that money changes hands efficiently.

So how do trades actually get made? That was the part I found really surprising. We made our way through the floor to the trading post where ZD stock was to be officially traded for the first time. I could see papers with hand-scrawled numbers being passed through the crowd, and I could hear the din of people shouting numbers back and forth.

Finally, Eric's daughter wrote down the information for the first trade on a sheet of paper and handed it to a trader. The first trade was made.

That's when it struck me. The exchange has all this technology, which it uses to track the results of trades and make sure things move smoothly. Traders use technology to see information on particular stocks and on the market as a whole. But when the trades actually get made, a lot relies on old-fashioned methods—pencil on paper and people shouting. Everything depends on individuals deciding what they want to buy and sell.

In some ways, that's a little scary, but in other ways, it's comforting. There's a little geek in all of us, and we all love to be wowed by great new technology. But it's also good to remember that after all the technology is stripped away, the work still comes down to people.


MICHAEL J. MILLER

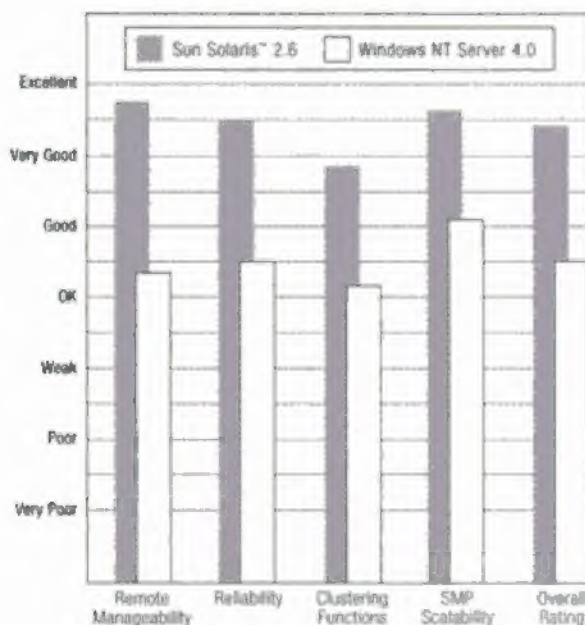
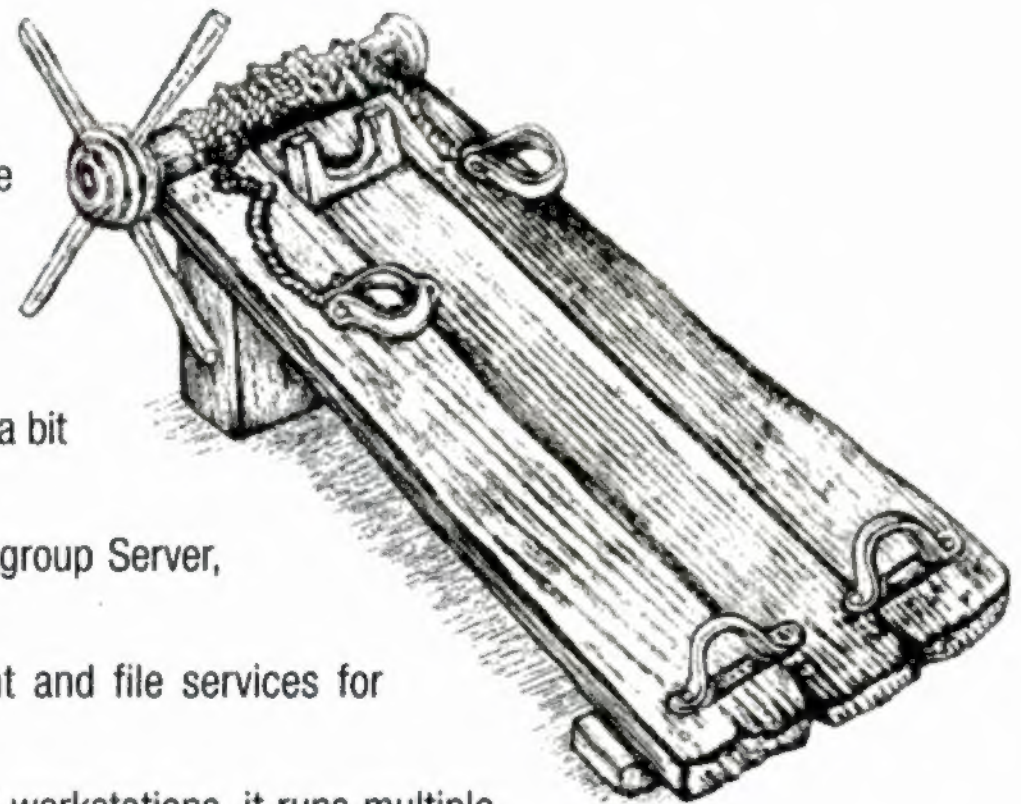
RUNNING ENTERPRISE APPLICATIONS ON AN NT SERVER?

Whatever you choose to do in the privacy of your own office is your business. But if you rely on a Microsoft Windows NT Server to run your company's key business applications, the result could be torturous. In fact, according to D.H.

Brown, servers running on Windows NT "continue to fall short of being able to support enterprise requirements.*" So why not indulge in something a bit

less agonizing? The Sun™ Enterprise™ 450 Workgroup Server,

starting below \$15,000, not only delivers print and file services for



*D.H. Brown Associates, Inc., March 1998

your PCs and workstations, it runs multiple

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Sun Enterprise 450 is part of a family that scales up to 64

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scalability. Plus, Sun supports their entire line of servers with

worldwide customer service. So call 800-SUN-FIND or visit sun.com/wgs/pmg to avoid a potentially

painful situation. Unless, of course, you're into that sort of thing. THE NETWORK IS THE COMPUTER.™



WHAT IS IT YOU PEOPLE DO FOR FUN?

*Refers to D.H. Brown Associates, Inc., Solaris Outpaces NT For Enterprise's Intranets, March 1998 study comparing Microsoft's Windows NT Server 4.0 with Sun's Solaris 2.6 operating environment.
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UP FRONT

From the Editor-in-Chief	4
Pipeline	9
Letters	21
Trends	28
▶ Calling all Piloteers	
▶ Gates pumps up cable connections	
▶ Inside PC Labs	
▶ Tuning in to Web radio	
PGs	35
▶ Graphics workstations	
Software	36
▶ Disk-cloning utilities	
Peripherals	38
▶ 19- and 20-inch monitors	
▶ DVD upgrade kits	
Internet	40
▶ Web-based presentations	
Networking	42
▶ LAN analysis tools	
First Looks	45
▶ Windows CE devices take on the Palm III	



- ▶ Plug-ins for Adobe Photoshop
- ▶ HP Printer/Scanner/Copier 380
- ▶ Olympus FlashPath
- ▶ SkyMap Pro
- ▶ RouteFinder GPS for Windows 95

Second Looks	79
▶ PowerDesk Utilities 98	
▶ Fixes for popular utilities	

COLUMNISTS

JAKE KIRCHNER	30
BILL MACHRONE	85
JOHN C. DVORAK	87
INSIDE TRACK	89
JIM SEYMOUR	93
BILL HOWARD	97

COVER STORY

What You Need to Know About Windows 98

BY MICHAEL J. MILLER

We took an early look to get you started thinking about whether, when, and how to upgrade. And upgrade to what? Windows 98 or NT?100



What's New in the Interface.....	102	Portable Power.....	116
What's Better About Hardware Support.....	104	What's Improved in System Diagnostics.....	118
USB, FireWire, and More.....	104	Windows 98 Troubleshooting.....	118
What's Faster About Performance.....	112	What's Cooler about Multimedia.....	122
Loading Applications Faster.....	112	TV on Your PC.....	122
What's Different for Laptops.....	116	What's Easier for Developers.....	125

FEATURES

SOFTWARE

Project Management Keeps You on Track

BY NELSON H. KING

If your projects involve too many tasks and too many people to keep straight, here's help.....209

CA-SuperProject 4.0.....	211	Editors' Choice.....	211
Microsoft Project 98.....	212	Getting More Out of Project Management Software.....	212
Project Scheduler 7.....	216	Project Schedulers: Painless Planning.....	214
SureTrak Project Manager 2.0	217	Project Management Terminology.....	217
Time Line 6.5.....	221	Performance Tests.....	222
TurboProject Professional 2.0.....	221		
The Phases of Project Management.....	210		

HARDWARE

High-End PC Graphics Cards

BY JON HILL

The OpenGL standard brings respectability to the PC as a 3-D graphics platform.....191

AccelEclipse II.....	198	3-D Tasks: Typical Chores for OpenGL.....	193
Diamond Fire GL 4000.....	202	The Newest Chips: Should You Wait?.....	194
Dynamic Oxygen 402.....	202	HP Kayak XW: Stepping Up to a Workstation.....	195
ELSA Gloria-XL.....	202	Performance Tests.....	198
Intergraph Intense 3D Pro 2200S.....	206	Summary of Features.....	204
Omnicom 3Demon MX16/16.....	206		
Editors' Choice.....	192		

PCs

Managed PCs

BY CADE METZ

A PC by any other name: You can use any of these 38 new PC models as standalone units, but these systems are packaged to be used as part of a network. Each is also equipped for remote desktop management. Flashy? No. Sexy? Hardly. But all make steps in the right direction, helping administrators as they try different methods to lower costs and bring order back to their network environments.....126

Aberdeen LLC.....152	ProGen Systems.....172
Acer America Corp.....152	Quantex Microsystems Inc. 172
ACMA Computers Inc.....152	Reason Computer Inc. 173
All Computer Technology.....154	Royal Computer Inc. 173
American Multisystems.....154	SAG Electronics.....173
Caliber Computer Corp.....154	SIA Computer Corp. 174
Compaq Computer Corp.....158	Sys Technology Inc. 174
Comtrade Inc.....158	Tangent Computer Inc. 176
Dell Computer Corp.....158	TigerDirect Inc. 177
Digital Equipment Corp.....159	Toshiba America Information Systems Inc. 179
DTK Computer Inc.....159	Total Peripherals Inc. 180
Everex Systems Inc. 160	Xi Computer Systems 188
Hertz Computer Corp. 160	Zenon Computer Systems Inc. 189
Hewlett-Packard Co. 160	
Hymco Technologies Inc. 162	
Maximus Computers.....162	
Mega Computer Systems.....164	Price/Performance Index.....128
Micro Express.....164	Editors' Choice.....129
Micro X.....164	The State of Desktop Management.....132
Micron Electronics Inc. 168	Glossary of Management Initiatives.....132
Monorail Computer Corp. 168	
NEC Computer Systems Division.....168	Vendor and Service Reliability.....143
NexTrend Technology Inc. 170	Performance Tests.....146
Polywell Computers Inc. 170	Summary of Features.....178
Premio Computer Inc. 172	



SPECIAL PULLOUT

A Guide to Desktop Management

BY ANUSH YEGYAZARIAN

Get a good grip on the PCs under your control. We have a dozen tips to help you do it, plus information on the top enterprise management packages to help you avert problems and save money.....135

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Net Tools

Network Switches.....225

Fast Ethernet switches cut congestion.



From the Bench.....239

► Fluke Network Inspector 2.1

► Sequel technology: Sequel Net Access Manager 4.0

Internet Tools.....245

Enhance your Web site with Active Server Pages.

PC TECH

Graph Libraries.....253

Five packages that add graphing to your apps.

Tutor.....263

How your PC's microprocessor can "think."

Operating Systems.....267

The Windows Scripting Host can automate file management.

Utilities.....271

Fix Windows 95 file association problems.

PC SOLUTIONS

User-to-User.....275

Ask Our Advisors.....276

AFTER HOURS

The Write Stuff.....319

Four résumé writing programs designed to help you land the perfect job.

Also in This Issue:

PC Magazine Marketplace.....	294
BusinessCard.....	316
Editorial Product Index.....	328
Advertisers' Index: Companies.....	329
Coming Up.....	327
Advertisers' Index: Products.....	330
Abort, Retry, Fail?.....	334



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Pipeline

Intel: Coming Attractions

From notebook power-management techniques to multiprocessor workstations for special-effects rendering, Intel is working on a new crop of technologies slated for delivery this year and next.

Intel expects 300-MHz notebook processors based on the mobile Pentium II to be available this year; it's scheduling 333-MHz notebooks for next year. It also plans to ratchet up the memory interface for notebooks from 66 MHz to 100 MHz in

life. When plugged into an AC power outlet, the processor will run faster.

Intel is hoping that basic PCs will move from the 233-MHz Pentium MMX to its new low-cost 266-MHz Celeron in 1998, and it hopes they will shift to 300 MHz by the first half of 1999. Also next year, Intel plans to introduce a significant new chip set for basic PCs that integrates graphics functions, reduces system complexity, and lowers design costs.

This summer, the company



1999. In April, Intel boosted the memory bus for desktops from 66 MHz to 100 MHz with the debut of its 350- and 400-MHz Pentium II processors, an upgrade that provides 50 percent more bandwidth to memory.

Power management technologies that go beyond those of notebooks today are also on the drawing board. One will slow the processor when run on battery power to extend battery

plans to introduce its high-end Pentium II Xeon processor, the first to be based on the Slot 2 module design. A new chip set, scheduled for debut at the same time, will support up to four processors and 8GB of memory. There's also a rumor that Intel is defining a future processor, code-named Tanner. Intel has neither released details on that chip nor acknowledged that it is in the works.

Fast Cash

Every year more than 3.4 million small-business owners go through the often-complicated process of applying for financing. Intuit, in partnership with American Express, Citibank, and seven other financial institutions, has opened the Quicken Business CashFinder (www.cashfinder.com), a Web service where small businesses can apply for financing.

Intuit designed the downloadable software to simplify the process of comparing options from multiple institutions. Once you fill out an application, you print it and mail it. Approval comes directly from the financial institutions, at which point you can compare deals.



Is a Windows Upgrade in Your Future?

25%

of respondents to a recent PC Magazine Online poll told us they intended to upgrade to Windows 98 as soon as possible. But 37 percent said they'd wait until the first bug fix, and 38 percent said they didn't intend to upgrade at all. We'll check back after it ships.

Spend Your Layover in the Office

Airport layovers are a prime waste of time, especially for business travelers. Even with a fully equipped notebook, it's hard to be productive in a noisy waiting area or club lounge. Seattle-based Laptop Lane (206-386-5800) hopes to change that by building offices in 60 airports nationwide and 30 more internationally within five years.

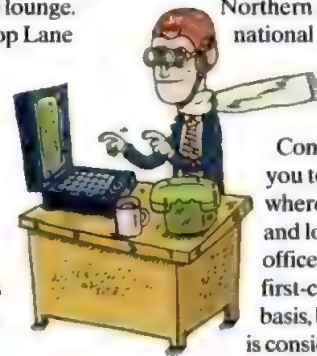
"Research shows that on the average, business travelers have more than an hour of free time at airports," says Bruce Merrell, president of Laptop Lane. The offices, located at airline terminals, will consist of suites of private rooms with desktop PCs, notebook connections, laser printers, fax ma-

chines, multiline phones for conference calling, and T1 Internet connections.

One office is already up and running in Cincinnati/Northern Kentucky International Airport. When you walk into the suite, a "Cyber

Concierge" takes you to an office, where you can close and lock the door. The offices are taken on a first-come-first-served basis, but the company is considering advance bookings.

Laptop Lane is open 16 hours a day, 7 days a week and costs \$8.95 for half an hour (long-distance calls and faxes are extra). Laptop Lane plans to open in the Seattle-Tacoma airport in June.



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Benchmark Tests: The Latest PC Lines

This issue's cover story on new PCs continues online, with downloadable performance tests and summaries of features.

Second Looks: Your Opinion Counts

You've used the products; now tell us what you really think. We ask for your opinions every Friday.

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Who's coming out with 400-MHz PCs? Have you seen the new offbeat Web browsers? Bookmark our improved new-product announcements.

Pipeline

A New JavaOS Is Born

In an effort to boost adoption of network computers, IBM and Sun have announced that they will develop JavaOS for Business to attract corporate network managers to thin-client platforms.

The summer delivery of

JavaOS for Business is likely to be a critical test of the network-computer concept. Java's backers—from IBM and Sun to Netscape and Oracle—have received widespread criticism for delivering multiple plat-

forms for Java, each with its own bugs and idiosyncrasies. "The object here is to help companies realize the true benefits of thin-client network computing," says Janpieter Scheerder, president of Sun's SunSoft division.

Essentially an enhanced

version of Sun's JavaOS for NCs, the new operating system differs from other Java environments in enabling central management of Java applications from cross-platform servers. And in contrast to JavaOS for NCs—which drew criticism from network man-

agers because it didn't allow for easy development of extensions such as device drivers—JavaOS for Business has cross-platform server-manageability modules, support for more languages, and more flexibility with

newly added device drivers.

Like JavaOS for NCs, JavaOS for Business permits storing applications on servers, so thin clients without much local storage can run line-of-business applications (such as those for inventory tracking) from a server.

The Guts of JavaOS for Business

IBM's and Sun's new operating system will have several features designed to appeal to IT managers, including:

- modules for central management from cross-platform servers;
- flexibility with newly created device drivers;
- support for several languages;
- support for many types of processors, including x86 chips.

Feeds for Different Speeds

RealNetworks has a plan to move Web-based streaming media to the next level. The company has announced a next-generation version of its playback software, RealPlayer, as well as new server software—RealSystem

G2—that incorporates emerging standards for audio and video.

RealSystem G2 supports two new media types called RealText and RealPix (a LivePicture format), a music codec designed to increase the frequency response of audio by 80 percent for 28.8 modem connections, advanced video filtering, and a custom transport technology called SmartStream, which is designed to scale media files for delivery at different data-transfer rates automatically.

These technologies are built around an enhanced version of RealPlayer Plus, called RealPlayer Plus G2. RealSystem G2 supports SMIL (Synchronized Multimedia Integration Language), the World Wide Web Consortium's standard for integrating disparate media types within unified presentations, as well as RTSP (Real Time Streaming Protocol). RealNetworks expects to complete the software later this year.

THIS ISSUE'S CONTRIBUTORS: Angela Hickman, Carol Levin, Sebastian Rupley, and Don Willmott.



E-Shopping, Microsoft's Way

Microsoft is seeking to broaden its reach in the world of Internet commerce. The company is launching new versions of its Site Server and Site Server Commerce Edition, and it has arranged with Pandesic (Intel's and SAP's partnership for creating commerce applications) to bundle Pandesic's commerce applications with Microsoft Site Server Commerce Edition. That bundle, in turn, will be offered to ISPs along with Microsoft Commercial Internet System (MCIS).

Microsoft's objective is to provide software for all the branches of commercial transactions on the Internet—at the user's end, at the commerce site's end, and at the Internet service provider's end. The bundling of Site Server, MCIS, and applications could be of particular interest to ISPs, which Microsoft CEO Bill Gates says are poised to become key parts of the e-commerce infrastructure as electronic transactions proliferate.

Top-Selling Digital Cameras

Sony MVC-FD7 (\$630)

Sony MVC-FD6 (\$454)

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Source: ZD StoreBoard (www.zdinfoboards.com). Data for March.

Phone Browsing

Internet screenphones and videophones—standard telephones that display Web data and video feeds on tiny screens—are on the rise, according to market researchers at International Data Corp. "The expansion of this market has been explosive," says IDC analyst Sean Kaldor, and it will reach 9.5 million units by the year 2002. Alcatel, Nortel, and Philips are among companies with new products in the category, with Nortel's PowerTouch line leading the market.

Newspaperless

By 2005, senior executives expect to rely on the Web as a primary source of business news, pushing aside daily newspapers and radio news.

Number of senior executives who expect to use each medium as an important source of business news in 2005.

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TV

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E-mail

Internet

Source: Deloitte & Touche LLP Millennium Survey, April 1998

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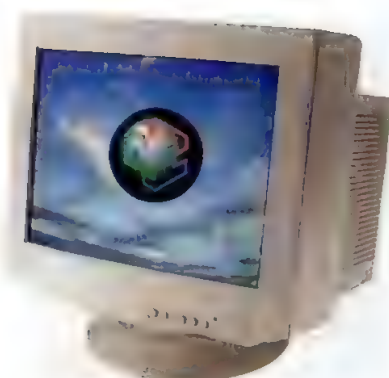
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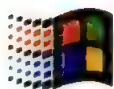
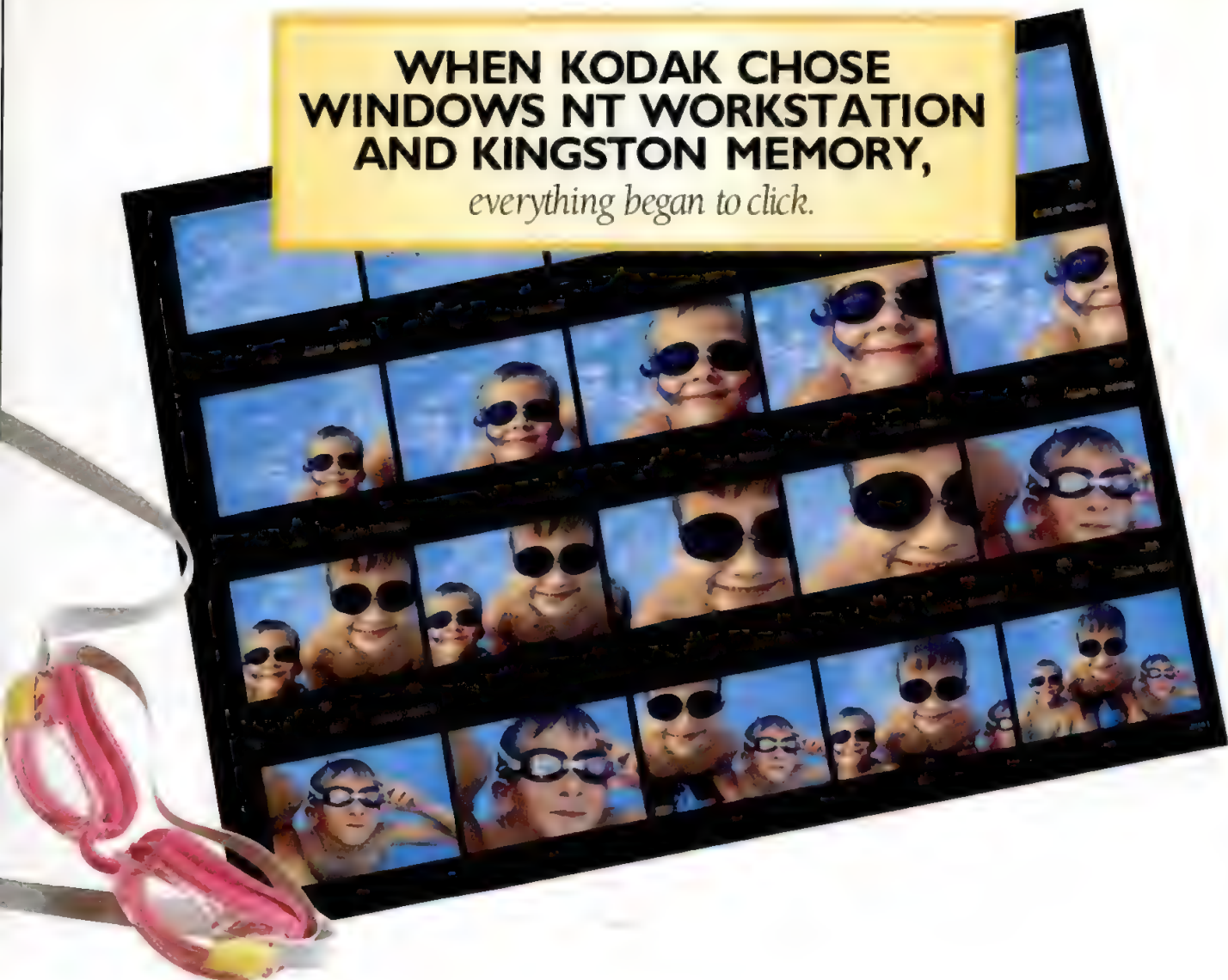
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WAYNE LOUIS HOYENGA
Urbana-Champaign, Illinois

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R.J. BOSNAK
Melbourne, Florida

AOL E-mail's address book is a *FIFO list*: The first name you entered goes on the top of the list, and new entries are added below. Once you have entered 20 or 30 names, finding the name you want becomes very difficult. CompuServe Mail, by contrast, automatically alphabetizes names. Because CompuServe Mail does not force you to enter e-mail addresses, the service searches its database as you type in the recipients' names, a great time-saver. To e-mail my friend Lance, I need only type *L* and click on Enter; for one of the two Lindas on my list I type *Li*, and I type *Linda S* for the other. If this earns CompuServe Mail only a *fair* rating on your table, I'd love to see what an excellent service is like.

IVAN BERGER
via the Internet

FORT APACHE

Though your story "Web Servers" in the May 5 issue was informative, the general Wintel orientation of your publication may have influenced your review of the Apache HTTP Server 1.2.5. One does not expect *PC Magazine* to review beta products, but you could



"Security becomes more important in e-mail as time goes on."

have mentioned Apache 1.3 as an upcoming alternative.

RICK KOEHLER
via the Internet

You stated that a significant flaw in Apache was its lack of remote browser-based administration. Although you mentioned telnet as an option, you missed the point. Under Unix, telnetting to another machine means getting the full graphical user interface (GUI) remotely. Thus, sitting at a remote machine is identical to sitting at a local machine. This method is much more powerful than any Web browser-based utility could be. Also, in the free software world, it makes little sense to package everything in one piece of "bloatware"; it makes much more sense to offer several simple, expandable programs that work together. Following that philosophy, Apache does not come with excess features in the core program.

PIOTR MITROS
via the Internet

Although I found your latest Web server roundup informative, the inclusion of information on cost per request per second would have been useful. Without this information, comparing the Windows NT solution to the Sun Solaris solution is difficult.

DAVID FEARN
via the Internet

EVALUATING ESSENTIALITY

Half a year ago I would have agreed wholeheartedly with your inclusion of the Hughes DirecDuo in your April 21 cover story ("Hot

Products: 160 Essential Hardware Accessories"). But many of us who have experienced the "service" Hughes Network Services offers its DirecPC customers might be pardoned if we have a completely different opinion. Having owned my DirecPC dish for about a year, I've noticed a marked deterioration in its "blazing Internet access" speed within the past six months. On many occasions, my download speed is slower than that of my 56K modem. This has not always been the case. I actually used to get the speed that Hughes still advertises. Basically, using the dish in the manner for which it is advertised—downloading large files at high speed—is reason enough to experience "temporary throughput limitation."

JOHN C. ANDERS
via the Internet

You commented that Microsoft made the Microsoft Natural Keyboard Elite smaller to fit in standard keyboard trays. But what exactly did Microsoft do to shrink it down? The cursor keys have been made smaller and are in a diamond shape instead of the standard upside-down T shape (which most of us are intimately familiar and comfortable with). The cursor keys are basically unusable for me, and my hands are not large. I have one of the original Natural Keyboards, and I am very happy with it.

ALAN PERRY
via the Internet

Your story probably contains some valuable information. Unfortunately, the chaotic page layout and tiny print make it so painful to read that I just couldn't make the effort.

CHARLIE BRENNER
via the Internet

Although I found nothing wrong with the information in the story itself, the page design and layout were somewhat jarring. I skipped over the article at least twice when browsing through the magazine because I thought it was a catalog advertisement. Though some people may think this is a minor quibble, I like paging through before I look at the contents to look at articles that grab my attention. When the article is so unlike your standard look and feel, you create a danger that people will page past it.

TOM SPRING
via the Internet

PC TECH SITE TOP-NOTCH

By far the most useful technical site on the Web is your PC Tech site (www.zdnet.com/pcmag/ptech). Although other sites provide more technical programming-style knowl-

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FRANK ENDOM
via the Internet

DOWN MEMORY LANE

I enjoyed the walk down memory lane in the May 5 PC Tech Tutor column ("So What's an Operating System, Anyway?"). Though I did put DOS-based applications to productive use, I would not want to give up the power and reliability that Windows NT brings to my desktop. Most of the improvement was realized with Windows NT 3.51; Version 4 was just a minor upgrade. Your comparison of a computer and its OS to a car and its exhaust system was apt but incomplete. Using Microsoft strategy, your Buick would run only with a GM muffler, and if you took the muffler off, the car wouldn't start.

STEVE GROSKREUTZ
via the Internet

MODESTY?

Michael J. Miller's proposal for Microsoft ("A Modest Proposal," May 5) stands out as the most sane response to all the anti-Microsoft insanity now flying around. I hope Microsoft is listening.

MARK E. ALSOP
via the Internet

Microsoft does not belong to Miller. It's not his to regulate or break up. The existence of regulation and antitrust in this country is unconstitutional. They violate the right to private property. And please don't tell me that regulation and antitrust protect competition; that argument is based on the socialist fallacy that

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Corrections and Amplifications

The illustration credit for David Bamundo was mistakenly omitted in the May 26 Trends article "Web Phones Untangled" (page 29). On the same page, the credit for Thom O'Connor's photograph for the article "Deconstructing 3-D Graphics Tests" was left out.

In the May 5 story "The New Networked Computers," \$1,230 is the list price (not the street price, as stated) for the Boundless Viewpoint TC Model 200.

In the May 5 Trends/Software story "E-Mail Extras," the URL for Simplify Development Corp. should have read www.simplifyinc.com.

In the May 5 Trends/Networking story "A Copy for Safekeeping," we reported an incorrect price for Computer Associates' ARCserve Replication for Windows NT. The correct price is \$2,995.

In our March 24 Utility Guide ("E-mail Notifiers," page 215), we said that NewMail 2.1 can monitor only one e-mail account. In fact, it can monitor more than one.

a free, unregulated market will inevitably lead to coercive monopolies. Only the government has the force to establish a monopoly. The concept of free competition enforced by law is a grotesque contradiction.

BILL DONABEDIAN
via the Internet

COMPUTER CHARITY

My old company had been interested in donating PCs for some time, often in significant quantities. The equipment being discarded is generally three to five years old and was once premium equipment. I have wasted countless hours trying to locate clearinghouses or charities that can use such equipment. Jake Kirchner's article ("Computer Donations: Get Behind It," April 21) would have been more worthwhile if he had included several points of contact. Without providing these, he is merely encouraging others to spin their wheels as I have done. This topic deserves a full feature article.

JAY GARNIER
via the Internet

Thanks to Kirchner for the information on computer donations. We have about 450 personal computer user groups in the nonprofit Association of Personal Computer User Groups (APCUG), from all over the world. Many of them have community service projects in which volunteers take in discarded and donated computers and fix them up, then donate them to schools, churches, the disabled, senior centers, and so on. To find a user group in your area, you can check our Web page at www.apcug.org. I can give you dozens of heartwarming success stories in which volunteers in our groups have changed people's lives.

DAN HANSON
President, APCUG

HIGH-TECH PHILANTHROPISTS

Bill Machrone's column "High-Tech Philanthropy" (April 7) missed a few key high-tech-industry philanthropic organizations. The David and Lucille Packard Foundation (www.packfound.org) and the Hewlett Foundation (www.hewlett.org) are two of the

largest charitable foundations in the country, with grants for the environment and many other important issues. A newer entry into the field is the Brainerd Foundation (www.brainerd.org), started by Paul Brainerd, the father of desktop publishing. Aside from funding environmental concerns, Brainerd has been instrumental in starting Social Venture Partners, mentioned by Machrone. And Paul Allen, cofounder of Microsoft, has started five foundations for various issues (www.paulallen.com/foundations).

SCOTT HIGHLEYMAN
Bellingham, Washington

DIGITAL DEBATE

I agree with all Jim Seymour said about the capabilities and limitations of digital and film cameras ("Digital Cameras: Reality vs. Hype," April 21). But he should have mentioned the option of taking pictures with a film camera and scanning the prints into digital format. Color scanners that produce excellent results are relatively inexpensive. One can have high-quality prints and digital copies for very little money.

DENIS HAYNER
via the Internet

THE FLAT FUTURE

I always enjoy John C. Dvorak's column, but I disagree with his assessment that LCD projectors will supplant flat-panel TV ("I Have Seen the Future," April 21). He mentions several things himself that will keep this from happening. First, projecting on a wall with even the faintest tint to it will result in colors being thrown off. The easy workaround is to hang a projection screen on the wall, which sacrifices portability. Dvorak also mentions that bulbs are expensive, and 1,000 hours is not a long time for a home TV to be on. He notes that projectors are dangerously bright, yet he believes that the need for a dim room will diminish with improvements in technology. Well, that "improvement" amounts to a brighter bulb, which is even more dangerous; that's the only way to keep extraneous light from washing out an image.

JAMES FUDGE
via the Internet

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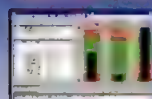
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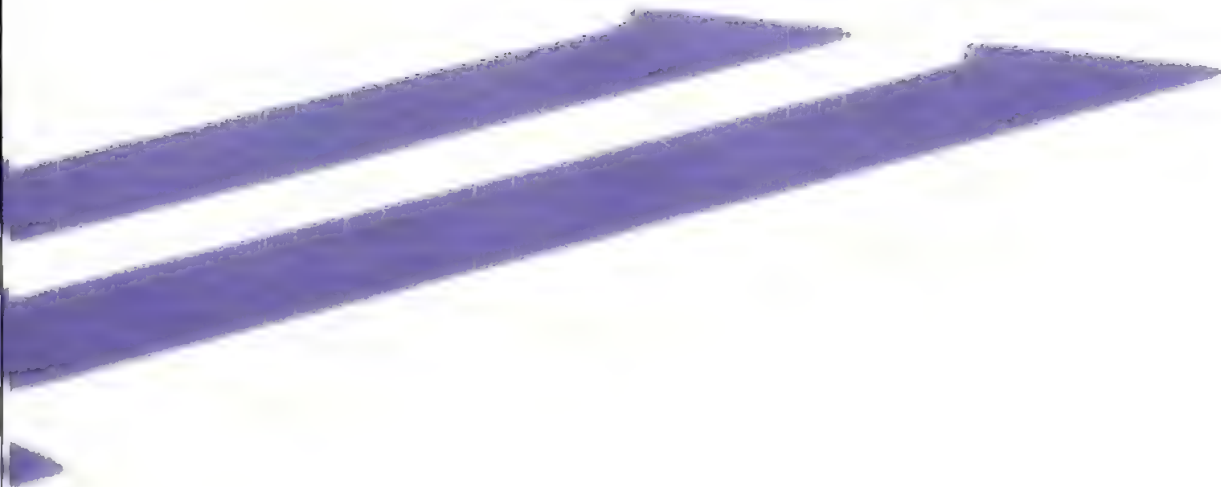
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Trends

Power in Your Pocket

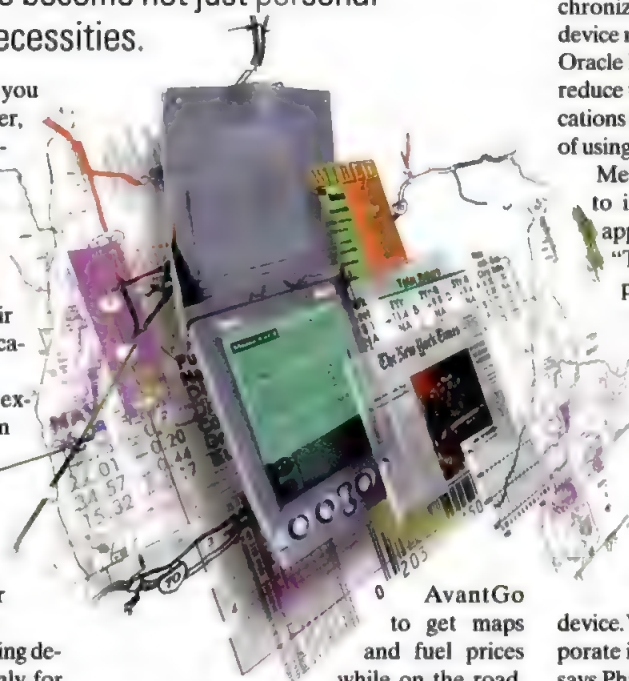
Hand-held computers have become not just personal organizers but business necessities.

Want some advice? Next time you purchase a hand-held computer, save the sales receipt. The device could just qualify as a business expense. In the latest trend to hit the hand-held market, the popular personal productivity devices are becoming must-haves for a growing mobile work force who need access to their corporate networks but are only occasionally connected to them.

Sales of hand-held computers are expected to grow from 3 million units in 1997 to 13 million units by 2001, according to market research firm International Data Corp. And analysts expect that Windows CE-based hand-holds will help fuel that surge, as they compete with 3Com's popular Palm family of hand-held computers.

That kind of market potential is driving developers to build applications not only for personal use but also for business. Much of the development work is taking place on 3Com's Palm Computing platform, with over 1,000 applications and games so far. The platform has five components: the hardware design, the Palm OS, the HotSync data synchronization technology, the applications programming interface, and the software interface for supporting hardware accessories.

Start-up AvantGo has developed a miniature browser, AvantGo Web Client, which sales reps are using to download pricing and product information to their PalmPilot for off-line access. And truck drivers are using



AvantGo to get maps and fuel prices while on the road.

The software's next version will support forms, letting mobile workers send information back to the corporate network. And in July, the company plans to release its Mobile Application Server, which will let network managers deploy and configure applications from a single location to far-flung mobile work forces. AvantGo is also signing on publishers to deliver information over its mobile system. It recently made deals with cnet, Excite, InfoWorld, Mercury Center, The New York Times, and Wired to deliver daily news, business, technology, and investment stories to hand-holds.

Heavy hitter Oracle also wants a piece of

the corporate hand-held market. By the end of the summer, it plans to release its database Oracle Lite on the Palm, Psion, and Windows CE platforms. The software will run disconnected from the network and will automatically synchronize data with the server when a mobile device reconnects. According to the company, Oracle Lite on hand-held devices promises to reduce the cost of deploying enterprise applications for mobile workers to a tenth the cost of using Windows-based laptops.

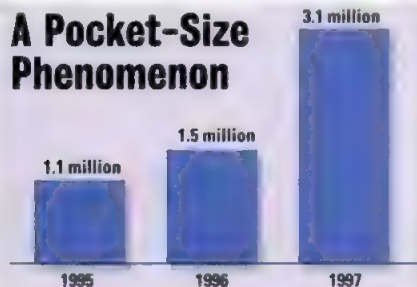
Meanwhile, Computer Associates plans to integrate its enterprise information applications with the Palm platform. "This alliance will give CA customers portable access to legacy systems and growing information resources from virtually anywhere," said Mark Bercow, a vice president at 3Com's Palm Computing division.

Developers are also extending the platform on the hardware side. Aironet Wireless Communications is working on a supersmall, low-power technology for wirelessly connecting hand-holds to a corporate network.

"The PalmPilot is currently a personal device. When you enable it to connect to corporate intranets, it becomes a business tool," says Phil Belanger, vice president at Aironet.

In another twist, Symbol Technologies, a developer of wireless networking and bar-coding devices, has licensed Palm technology for a bar code-scanning device. One of its first customers is the online grocery store Peapod, which will provide Symbol PalmPilots to employees at the warehouse so they can scan items' bar codes, create electronic shopping lists, and fill orders more accurately and quickly. Symbol expects the health-care, transportation, and package-delivery industries to use the souped-up Symbol PalmPilot for collecting and transmitting information from the field.—Angela Hickman and Carol Levin

A Pocket-Size Phenomenon

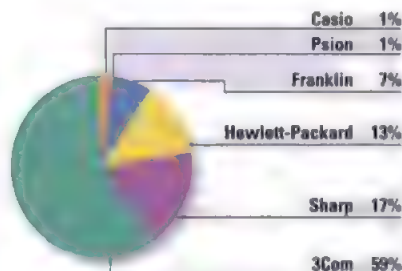


With worldwide sales of hand-held computers brisk...

Sources: IDC and ZD StoreBoard



...and the growth rate of the entire hand-held market far surpassing that of desktops...



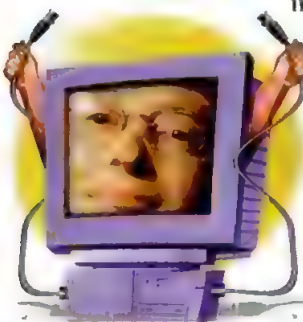
Data as of March 1998.

...3Com's Palm Computing division has captured more than half the market.

Gates Pumps Up Internet Cable

The cable industry gets a nudge.

Although he has vocally supported DSL (Digital Subscriber Line) for providing high-bandwidth Internet connections over phone lines, Microsoft CEO Bill Gates is urging the cable industry to help implement high-speed connections over cable modems. "The cable industry will lead the way to provide



information-age services in the homes of the world," Gates said at the recent National Cable Television Association conference.

He demonstrated several examples of how marriages

among cable modems, telephony, cable companies' software, and Windows might look. Microsoft has also formed a pact to promote cable modems—the Cable Broadband Forum—with Intel, TCI, and Time Warner.

With a representative from the Cable Television Association conference, Gates demonstrated how interactive services might look using software from a cable provider and a cable modem. With an application called Web CSR running on a TV with a cable modem and set-top box, you'll be able to upgrade cable services, select programming packages (such as a sports package combining events from different cable channels), and check balances.

Another demonstration incorporated a digital signal to illustrate what digital-TV services might be like with cable modems. The demonstration included user-selectable 11-Mbps video streams on topics associated with a television broadcast. As cable channels changed, an on-screen toolbar that controlled the video streams showed different choices.

Microsoft has much to gain from the proliferation of cable modems. It has invested \$1 billion in the cable company Comcast, acquired WebTV, and tuned its operating system Windows CE for set-top boxes. But several high-speed Internet solutions compete with cable modems; DSL technology, in particular, has received Gates's backing as well.

There are signs that cable industry efforts in providing Internet services are picking up. One example: Microsoft has a 5-million-unit order from TCI Cable Systems for a Windows CE-based set-top box, manufactured by General Instruments.—*Sebastian Rupley*



Smooth Sounds, Clear Video

AT THE INTEL DEVELOPERS' FORUM IN MID-February, Frank Hady and Brad Hosler, senior staff engineers at Intel Architecture Labs, alerted attendees to a nasty hardware problem they called the "PCI Bad-Citizen Syndrome." They reported degradation, choppiness, and even complete failure of isochronous data transfers, such as USB or IEEE 1394 video and audio streams, on certain systems that otherwise seemed in perfect working order.

The problem surfaced when such streams occurred concurrently with standard PCI graphics operations. Since that meeting, Hady and Hosler have come up with a solution.

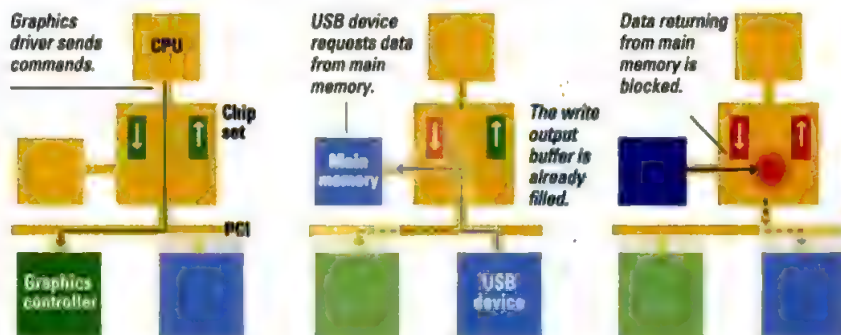
Further inspection with a PCI bus

LOOKING FOR A SHARE If a graphics driver continually writes to a PCI-based controller that is not ready to accept such data, no data destined for other PCI devices—such as an audio or video playback device—may be sent

even if the controller is not ready to receive—until the transfer succeeds. (The PCI 2.1 protocol allows this practice, although critics say it's a bug.) Intel has measured latencies of up to 20 milliseconds before the graphics controller receives the data. No other data destined for other PCI devices may travel through the host-bridge output buffer until the graphics controller accepts its data, which is queued in the buffer. As a result, audio and video-playback devices can't receive data from the CPU and system memory when they need to.

This syndrome can cause clicks and pops in audio, produce visual artifacts in video, or kill the streams altogether. Intel recommends that affected graphics board ven-

dors through the output buffer until the graphics controller accepts the data queued up in the buffer. As a result, the devices are unable to receive data from the CPU or system memory when needed.



analyzer led the engineers to discover that ill-behaved graphics board drivers were causing the problem. After PC Magazine Labs installed specialized PCI-based detection hardware received from Intel, we noted that two of six PCI-based OpenGL graphics adapters tested for "High-End Graphics Cards" in this issue—the Elsa Gloria XL and the Omnicomp Demon—exhibited the syndrome.

Here's the problem: Some graphics drivers continuously write data through the chip set's host-bridge chip to the driver's PCI-based graphics controller—

dors make a minor modification to their drivers to fix the problem. The upcoming PCI 2.2 specification will eliminate the problem by restricting retries to 10-microsecond latencies.

Intel suspects that certain graphics adapter vendors may not be aware of the problem, whereas others may purposely use the behavior to increase benchmark test scores slightly. A solution is on the way. A detection card, which vendors can use to test their products, will soon be available from the PCI Special Interest Group at www.pcisig.com.

—*Nick Stam*

Good Morning, Cyberspace

Improved technology and content are turning Web radio into a mass medium.

Do you listen to the Internet? If you don't already, you probably will soon. Internet-based radio is taking off in a big way as the nation's biggest broadcasters flock to the Web. ABC Radio Network, for example, recently signed a deal with RealNetworks (www.real.com) to broadcast all 27 of ABC's radio stations on the Web. (RealNetworks is the maker of the ubiquitous RealAudio Player.) ABC Radio has an estimated audience of 150 million people per week in more than 90 countries. With those kinds of numbers, it doesn't take a Ph.D. to recognize the implications for the future of Web radio.

Thanks in part to improved tools and technologies (Web-based audio now offers near-CD quality, even over a 28.8-Kbps modem) and scores of new big-name content developers, Web sites are bringing in new eyeballs—and ears—and are keeping them there. The number of Web pages with

streaming media has increased more than 50 percent since February, according to RealNetworks, and more than 85 percent of these pages are using RealAudio and RealVideo. Furthermore, users are downloading RealNetworks' RealPlayer 5.0 (the newest version of the streaming-audio player) at a rate of more than 600,000 per week, bringing the number of downloaded players to more than 35 million.

For the business market, RealNetworks has collaborated with MCI on the Real Broadcast Network, which broadcasts content over the Internet to large audiences. In addition to ABC Radio Network, a slew of other content developers and entertainment companies use the technology, including Atlantic Records, BMG Entertainment, Capitol Records, Columbia TriStar Pictures, Comedy Central, Court TV, Disney Online, Electronic Arts, Elektra Entertainment Group, ESPN SportsZone, Geffen, Virgin Records, Warner Bros.

Radio Fever

The Web is a sea of sounds where you can listen to everyone from Rush Limbaugh to Beethoven. Here are a few of our favorites:

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www.king.org
- Book Radio**
www.bookradio.com
- PC Week Radio**
www.zdnet.com/pcweek/radio
- Talk America**
www.talkamerica.com
- Imagine Radio**
www.imagineradio.com

Online, and Warner Bros. Records.

A similar product, AudioNet (www.audionet.com), delivers radio and television programming to more than 325,000 visitors a day. Companies can use the technology to deliver audio from press conferences or shareholder meetings, for example, to targeted audiences over the Internet.

—Angela Hickman

JAKE KIRCHNER

Messing with Our Future

I've spent a lot of time thinking about Windows 98 recently. And who hasn't? With the legal problems facing Microsoft as it moves toward product launch, Win 98 is the cause célèbre of the year.

Antitrust issues aside, there's no mystery about the product. Thousands of people have been using it for months, and you can find everything you need to know about it in this issue of *PC Magazine*. More interesting to me is the far-off follow-on to Windows 98 (call it Windows 2098). Of course, if the Justice Department and the attorneys general of several states have their way, we won't see any new version of Windows until sometime in the next millennium.

Seriously, though, the way we think of today's Win 98, technically and legally, has a lot of bearing on what the operating system will be 100 years from now. And what we hope for in a futuristic operating system should govern our actions today. My guess is that in 2098, there won't be an OS as we think of the concept today. The OS won't be distinct from the applications, the networking, or even the hardware that will make up the computing devices of the future.

Each personal computer—and there may be a proliferation of machines or one universal computing device—will include everything we need in one package. Perhaps on one chip. Perhaps on one chip embedded somewhere in our clothes. Or in our bodies. The device will do our bidding based on our spoken commands or our thoughts. It will react to our schedules, our whims, our emotions, with agents that allow us access to whatever information or entertainment we want and whatever computing function we need.

This kind of capability won't arrive whole and complete out of



the lab in a burst of innovation. Rather, it will build slowly over time, each improvement and technological breakthrough climbing on top of a predecessor. The operating system will gradually evolve to include the applications and the networking and become indistinguishable from the hardware. Windows already includes networking functions, and it would include full-blown applications if Microsoft didn't find selling them separately more lucrative.

With cheap memory and unlimited bandwidth, it won't matter whether the computing capability of this future is provided across the network (as in the Java vision) or carried on our persons (as in the Windows model). At some point, there won't be any difference between a network and a computer. Perhaps at that point, computing power will also be indistinguishable from broadcast technologies. And maybe computing power will be delivered along with electricity and become regulated like power and water utilities.

I don't know whether Microsoft will survive over the next century to build this capability. But I do know that personal computing will not reach its full potential if the legal forces around the country try to maintain "fair" and distinct markets for providers of operating systems, software applications, networking, and hardware.

These lines are going to blur no matter what anyone wants or does to manage the process. That doesn't mean there should be no checks on predatory practices or contracts that violate antitrust law. But no one should try to inhibit product development or technological innovation on the part of any company in this industry. That's not keeping Microsoft in line. That's messing with our future.



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<i>Family Series</i>	\$109 ⁹⁸	\$59 ⁹⁸	\$39 ⁹⁸
<i>4DX Series</i>	\$147 ⁹⁶	\$73 ⁹⁸	\$39 ⁹⁹

Compaq	64 MB	32 MB	16 MB
<i>Presario</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁸
<i>Deskpro</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁸
<i>Armada</i>	\$219 ⁹⁹	\$99 ⁹⁹	\$39 ⁹⁹

Micron Electronics	64 MB	32 MB	16 MB
<i>Millennia®</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁹
<i>Home MPC™</i>	\$109 ⁹⁸	\$59 ⁹⁸	\$39 ⁹⁸
<i>Powerstation®</i>	\$109 ⁹⁸	\$59 ⁹⁸	\$39 ⁹⁸
<i>ClientPro®</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁹
<i>Magnum™</i>	\$109 ⁹⁸	\$59 ⁹⁸	\$39 ⁹⁸

IBM	64 MB	32 MB	16 MB
<i>Aptiva</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁹
<i>300 Series</i>	\$109 ⁹⁸	\$59 ⁹⁹	\$39 ⁹⁹
<i>ThinkPad</i>	\$219 ⁹⁹	\$99 ⁹⁹	\$39 ⁹⁹

HP	64 MB	32 MB	16 MB
<i>Pavilion</i>	\$219 ⁹⁹	\$59 ⁹⁹	\$39 ⁹⁹
<i>Kayak</i>	\$139 ⁹⁹	\$59 ⁹⁹	\$39 ⁹⁹

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GRAPHICS WORKSTATIONS

Chasing the Heels of Unix

As leading manufacturers develop quicker processors, system buses, and 3-D accelerators, the performance gap between PC and Unix workstations continues to shrink. Not only have PC workstations become more powerful over the past few months, but they also offer their users a wealth of options among expansion choices, hardware components, and x86-based software.

Hewlett-Packard, Intergraph, and NeTPower have all launched competitively priced, dual processor-capable 3-D workstations running Microsoft Windows NT on a 400-MHz Pentium II. They are targeting these systems at animators, CAD professionals, digital-media artists, and others who work with high-end 3-D designs. But the workstations are also meant to be competitors in a market previously dominated by Unix systems.

The \$11,250 **HP Kayak XW PC Workstation**, from Hewlett-Packard Co. (800-752-0900, www.hp.com/go/kayak), attempts to enhance the quality of 3-D functions under Windows NT by using its HP Visualize fx4 3-D OpenGL

AGP graphics accelerator, which comes with 18MB of SGRAM frame-buffer memory and 16MB of SDRAM texture memory. Complementing this 400-MHz system are Intel's 440BX chip set,



POWER STATIONS: Systems from Intergraph (above) and Hewlett-Packard.

128MB of ECC RAM (expandable to 1GB of SDRAM), two Seagate 10,000-rpm, 4.5GB Ultra-Wide SCSI hard disks, an HP Fast RAID card configured for RAID 0, and a 32X CD-ROM drive to round out the graphics-oriented package.

For future expansion, the Kayak XW has three drive bays open for extra storage components, plus three free expansion slots. For monitoring and

managing the system's health, the Kayak XW boasts an HP NightDirector 10/100BT network adapter with Remote Power-On (which is analogous to IBM's Wake on LAN), a front-panel LCD diagnostic display, and the DMI-compliant HP Top Tools. You can purchase a 17-inch monitor for an additional \$500.

Intergraph Computer Systems (800-763-0242, www.intergraph.com/ics) is another PC workstation manufacturer that uses its own brand of 3-D graphics accelerators in its systems. There are two options. The Intergraph RealizM II 3D PCI accelerator with OpenGL support has up to 32MB of frame-buffer memory and up to 64MB of texture memory. The Intense 3D Pro 2200S AGP graphics accelerator also supports OpenGL and provides up to 16MB of frame-buffer and texture memory.

You can opt for either of these graphics boards when buying the **TDZ 2000 GT1 ViZual Workstation**. Priced with the Intense 3D Pro 2200S, the TDZ 2000 GT1 (\$7,900 street) includes a 400-MHz Pentium II CPU, a Reliance Champion 2.0 chip set, 64MB of ECC RAM, two Seagate 7,200-rpm, 4.5GB UltraWide SCSI hard disks, a 32X CD-ROM drive, and an on-board 3COM



Fast EtherLink XL 10/100Base-T Ethernet with Remote Wake Up. Add in the RealizM II 3D and the price jumps to \$8,850 (street).

The TDZ 2000 GT1 provides for both expandability and manageability. There are 8 free slots and 7 open drive bays for expansion, and the optional Tower-Mate Expansion Base can plug into the top of the Ultra-tower chassis to provide a total of 13 slots and 11 drive bays. The included InterSite desktop management system and network adapter let an IS department manage the system from a central location. Intergraph offers a range of monitors; a 17-inch monitor costs an additional \$550 (street).

Another big name in PC workstations, NeTPower (800-801-0900, www.netpower.com) has revamped its PC workstation line by including the faster Pentium II BX chip set and system bus. The \$8,925 **Symetra 4300** comes standard with 128MB of RAM, one Seagate 7,200-rpm, 4GB UltraWide SCSI hard disk, Windows NT, a 32X CD-ROM drive, an integrated Intel 82558 10/100-Mbps Fast Ethernet PCI bus LAN controller, and NeTPower's own AGP Silverpoint 5000 3-D graphics card. The card can support OpenGL, 32MB of frame-buffer memory, and 30MB of texture memory. For an additional \$775, you can add a 17-inch monitor.

The Symetra provides you with three open drive bays, three available PCI slots, one available ISA slot, and support for up to 2GB of system memory. Like the other systems in this roundup, the Symetra has system management functionality, thanks to the inclusion of Intel's LANDesk Client Manager.—Angela Tuka

And Now for Something a Little Different...

The eggshell color of most PC systems may look great in office cubicles, but you may want something more stylish if you're planning on setting up a PC in your living room or home office. At least that's the line of thinking that StyleTek Industries (212-420-1815, www.styletek.com) is following. To that end, StyleTek offers the **Artisan Collection** of PCs, which lets you choose mahogany, oak, or whatever wood best suits your room's decor.

StyleTek encases the system components in wood and assembles them per your

processor, hard disk, memory, and other hardware.

A mahogany chassis with a 233-MHz Pentium MMX, 64MB of RAM, a 1.1GB hard disk, a 56K modem, a Sound



Blaster sound card, a 24X CD-ROM drive, and an MGA Mystique 4MB PCI video card costs \$4,500. That doesn't include the matching mouse (\$100) and marble mouse pad (\$95), 120-watt pyramid speakers (\$699), a matching 17-inch wooden monitor enclosure (\$725), and IBM keyboard with hand-carved wooden keys (\$325).—AT

DISK CLONING

Send in the Clones

The process of configuring a single system and installing its software is tedious and time-consuming, not to mention a veritable nightmare for IS professionals and PC vendors. Cloning software can simplify the job by letting you configure one PC exactly as you want and then create a copy, in the form of an image file, of the system's hard disk. You can then load the image file onto multiple systems.

Innovative Software's **Ghost Multicast 5.0** (\$1,125 for 100 seats) offers a new graphical user interface and enhanced multicasting capabilities (800-817-5119, www.ghostsoft.com). Besides letting you clone multiple workstations across a network at one time, the improved multicasting now supports image-file partitions, so that you can clone selected partitions of a hard disk. Since every Windows NT workstation requires a unique security identifier (SID), cloning such systems can cause problems; Ghost Multicast handles conflicts with a free add-on, Ghost Walker, which assists in creating a unique SID for each workstation.

Drive Image Professional 2.0, from PowerQuest Corp. (800-379-2566, www.powerquest.com), has im-

proved usability through its revamped graphical interface and the addition of an image-creation wizard. The package (\$700 street) also includes a host of useful tools, ranging from the Image File Editor, for extracting and restoring individual files from within an image, to the ImageShield, which you can use for encrypting and password-protecting image files. The SIDchanger changes terminal-specific information such as user name and password when cloning Windows NT.

Micro House International's most recent entry in this market is the Windows-based **ImageCast Deluxe 2.1** (800-926-8299, [A screenshot of the 'Property Sheet' window for RapiDeploy. It has tabs for 'General', 'Computer Names', and 'TCP/IP'. The 'TCP/IP' tab is selected. It contains several checkboxes: 'Don't change TCP/IP settings', 'Use DHCP for all computers in this set', and 'Specify range'. The 'Specify range' section has input fields for 'From' \(192.168.10.1\) and 'to' \(192.168.10.102\). Below this are fields for 'Netmask' \(255.255.255.0\), 'Gateway' \(192.168.10.250\), and 'Domain' \(yourdomain.com\). There is a 'DNS/WINS' button. At the bottom, there is a checkbox 'Prompt user for confirmation of these settings' and four buttons: 'OK', 'Cancel', 'Apply', and 'Help'.](http://www</p>
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DISK IMAGE: RapiDeploy provides a window for setting properties.

microhouse.com). To simplify cloning, ImageCast (\$800 street) has a selection of various wizards; for example, the ClientBuilder guides you through creating boot disks for Microsoft and Novell networks. The program's multi-

casting capabilities let it deliver image files to multiple PCs over TCP/IP connections. For cloning Windows NT systems, there's an integrated Microsoft SID-creation feature. ImageCast also lets you customize Windows 95 and 98 network parameters in image files after they've been created.

Following along the lines of the other cloning products discussed here, KeyLabs' **RapiDeploy 3.1** (\$1,500 for 100 seats) lets you set up multiple systems simultaneously from one workstation (888-539-5227, www.keylabs.com). You do so primarily through the DOS-based Image Agent, which creates and uploads an image file and broadcasts it to target PCs. Two new tools—the Client Configuration Agent and the RapiDeploy Management Console—ease customization of each target computer with essential information, such as IP address and domain name.—*Matthew Graven*

UTILITIES

Optimum Performance

Utilities are designed to keep your system running optimally. Since our annual utility blockbuster (March 24), several new packages have hit store shelves.

Sterling Strategic Solutions (SOS) (800-427-9422, [\[saveoursystem.com\]\(http://saveoursystem.com\)\) has combined a Windows 95 data protection tool with an Internet filtering tool to create **SOS Pro** \(\\$90 street\). The configuration component lets you customize system settings and desktop configurations for multiple systems via a network, making it easy to standardize system setup and customization. SOS Pro protects the system settings. The filter provides typical filtering of Web content and lets you limit how much time employees can spend online. Wildcard options let you specify, for example, that employees can download only .org and .edu sites.](http://www</p>
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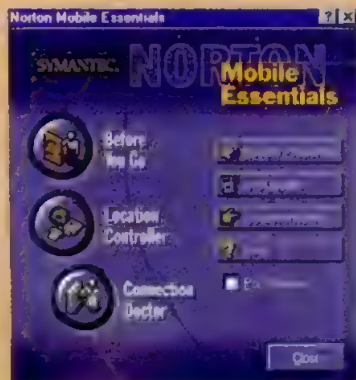
When installing new software causes a problem, uninstallers can reverse the changes in your system. **Guardian Angel**, from PowerQuest Corp. (800-379-2566, www.powerquest.com), aims to pre-

vent such problems from ever occurring. Guardian Angel (\$50 street) protects systems by warning you about potential conflicts, such as file overwrites, before any changes are made. Furthermore, it can restrict unauthorized users from making changes to a system.

TidyDisk 2.0 (\$20 street), from American Systems (888-892-

Norton on the Move

Finally, there's a utility designed expressly for the mobile professional. Symantec Corp.'s **Norton Mobile Essentials** (800-441-7234, www.symantec.com) is a unique package of notebook utilities that addresses the most common technical problems professionals experience while traveling (\$80 street). Norton Before You Go can archive important files to a network or floppy disk, and it can run a diagnostic to ensure that your modem is configured properly and your system is free of disk errors. Other components adjust your configuration settings as necessary and detect communications errors.—*MG*

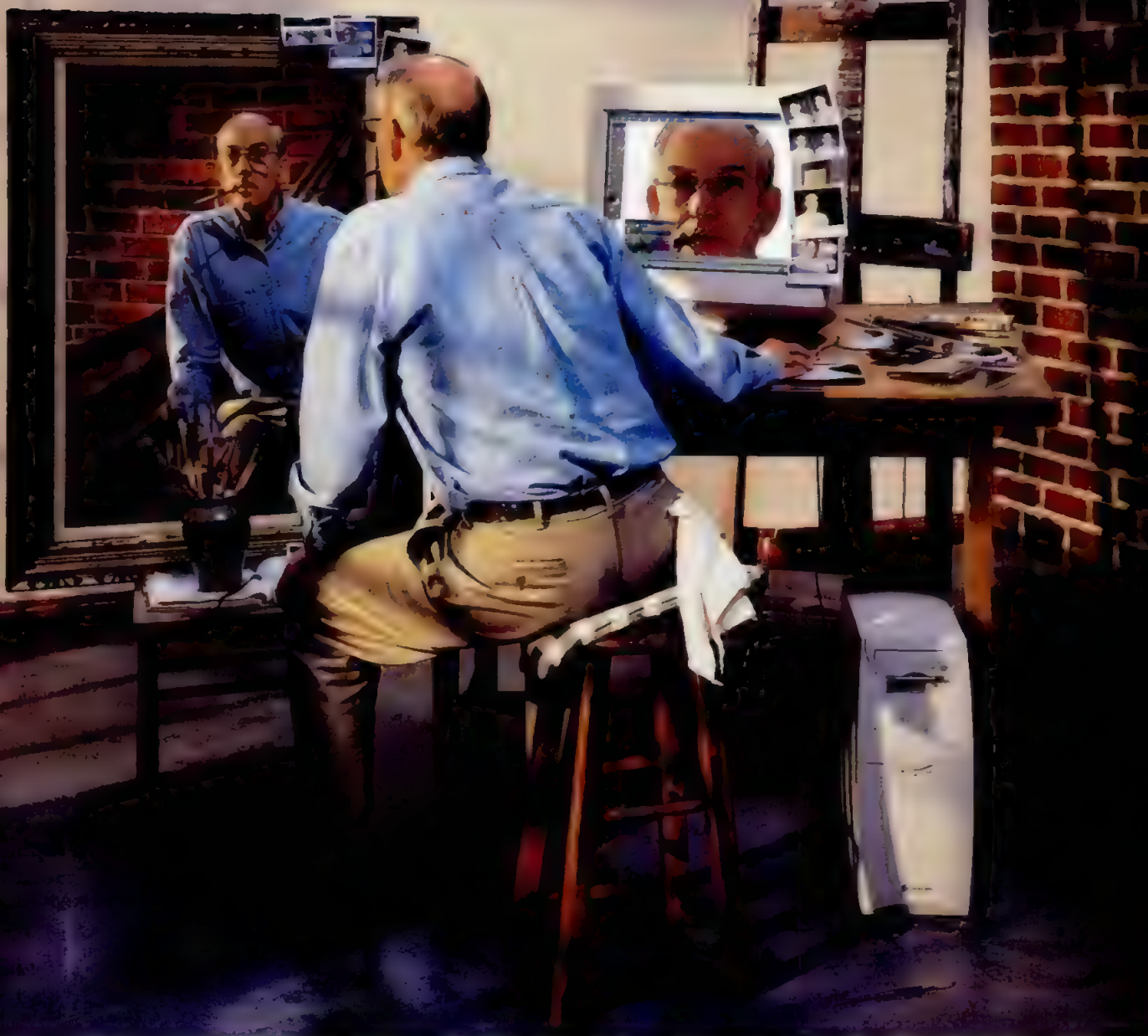


HIGHER POWER: Guardian Angel's history screen lets you view and undo activities.

4310, www.americansys.com), cleans up local and network drives by removing unnecessary files. Users can specify the types of files they want to remove, such as cache or temporary files; TidyDisk either deletes these files, moves them to another directory, or archives them into a ZIP file. You can run TidyDisk manually or schedule it using EZ Scheduler, American Systems' free scheduling program.—*MG*



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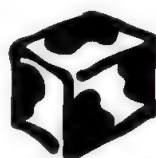
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36-inch SVGA Monitor

Data Grade CRT: 38" Diagonal (35.5" viewable) • Invar Shadow Mask • Resolution: 800 x 600 @ 60Hz • Unlimited Display Colors • Scanning Frequency: Horizontal, 31 to 37kHz; Vertical, 59Hz to 75Hz • Autoswitching PC/TV Mode Digital TV Capabilities Digital Line Doubling, Progressive Scan • Digital Comb Filter • Two-tap Vertical Line Interpolation • Five-tap Horizontal Line Interpolation • Brooktree 2164 Graphics Chip • 829a Video Decoder • 181-Channel, Cable-Ready TV/Tuner

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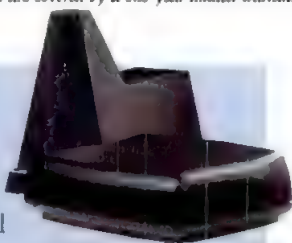
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- Hewlett-Packard OfficeJet 600 **\$499**
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MONITORS

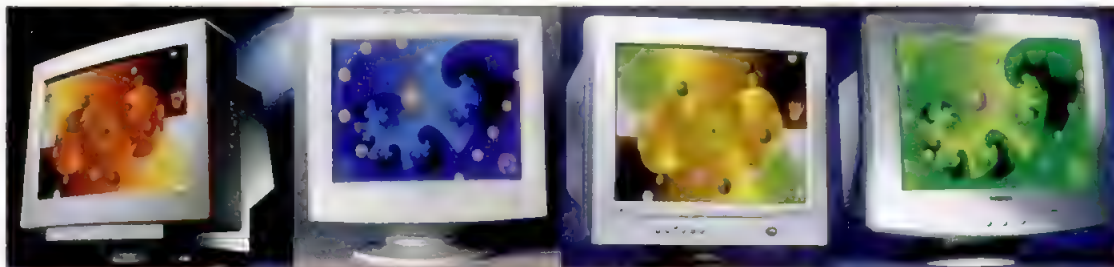
Sharper, Wider Images

The corporate manager with an eye on a budget often forgets that many high-end design projects require large screens and high resolutions. Several new offerings in the 19- and 21-inch categories aim to combine significantly expanded vision with reasonable prices.

Designed for corporate, small-office, and performance-driven home users, the **Multi-Sync E900**, from NEC Technologies (800-632-4636, www.nec.com), is NEC's first 19-inch monitor. The E900 (\$900 street) has a Microfilter CRT with a 0.28-mm dot pitch and an 18-inch viewable image. A special filter in front of the phosphors is designed to increase contrast by 20 percent and brightness by 15 percent. The maximum resolution is 1,600-by-1,200 at 73 Hz refresh. NEC's On-Screen Manager controls allow fine-tuning of image size, position, color, temperature, brightness, and contrast.

Nokia Display Products (800-296-6542, www.nokia.com) has released the **445XiPlus** (\$1,500 street), an enhanced version of

its 445Xi and part of its new Xi-Plus line for midrange corporate users. The 21-inch monitor has a



BRILLIANT DISPLAYS: The latest entries from EIZO, KDS, NEC, and Nokia.

19.7-inch viewable-image size, a 0.22-mm horizontal dot pitch, and a maximum resolution of 1,600-by-1,200 at 88 Hz. A dual-input D-Sub/BNC connector lets the user switch quickly between

two CPU inputs.

RECAP We tested 57 17- and 19-inch monitors for our October 7, 1997, issue. We awarded Editors' Choice to the iiyama VisionMaster Pro 17, Samsung SyncMaster 700b, and Sony MultiScan CPD-200SX.

For high-end graphics professionals who use desktop publishing and CAD/CAM software, EIZO Nanao Technologies (800-800-5202, www.eizo.com) has released

the **FlexScan FX-D7**. With a 17.8-inch viewable-image size, this 19-inch monitor (\$1,080 street) has a high-contrast tube, a 0.26-mm dot pitch, and EIZO's SuperErgo Coat antireflective, antistatic coating. The monitor's maximum resolution is 1,600-by-1,200 at 76

Hz. There's also an integrated USB hub to provide instant connectivity for up to four USB-compliant peripherals. For multimedia applications, the EIZO I-Sound detachable speaker unit (\$70 street) fits around the control panel console.

VS-19sn, from KDS USA (800-237-9988, www.kdsusa.com), might be your salvation. The VS-195 has a depth of only 18.9 inches, and the VS-19sn—which uses the new short-neck tube technology—has a depth of only 17.3 inches. Maximum resolution for

both monitors is 1,600-by-1,200 at 79 Hz. The VS-195 utilizes a Hitachi CRT with a 0.26-mm dot pitch; the VS-19sn's tube, which has a 0.25-mm dot pitch, is from Matsushita.—Sharon Nash

DVD UPGRADE KITS

Your Own PC Cinema

As more PC vendors ship systems with DVD-ROM drives, the DVD format continues to gain ground steadily. But if your system doesn't already have DVD, you'll need a special decoder to process the data. The latest wave of upgrade kits is targeted at cost-conscious consumers and offers everything you need to get started.

The \$349 **Sony DDU220E/H 5X DVD-ROM**, from Sony Electronics (800-352-7669, www.sony.com), combines a 5X DVD-ROM drive with a Sigma Designs



BIG DVD, SMALL PACKAGE: Sony's latest drive.

REALmagic Hollywood Plus decoder card for DVD MPEG-2 video and Dolby Digital surround sound. The bundle comes with a selection of DVD titles, including Funk & Wagnalls Multimedia Encyclopedia. The drive is fully compatible with current CD technology and can read CD-ROM, CD-R, and CD-RW disks. It's also read-compatible with DVD+RW media.

Diamond Multimedia Systems (800-468-5846, www.diamondmm.com) now offers the \$229.95 **Diamond DVD Kit, Model MC20**. Built around a 2X DVD-ROM drive, the kit includes a 2-D/3-D PCI-based graphics accelerator powered by Chromatic Research's Mpack 2 3DVD media processor. Packed with 4MB of RDRAM,

the card can display resolutions of up to 1,600-by-1,200 at a refresh rate of 200 Hz. It can also generate MPEG-2 video and six-channel Dolby Digital surround sound.

The latest from NewCom (800-563-9266, www.newcominc.com) is the \$499 **DVDII Multimedia Kit**, which bundles a 2X DVD-ROM drive and a DVD/MPEG-2 playback card. The card supports playback of DVD-ROM, DVD video, and MPEG-2 video at full screen or in a scalable window; TV-out interface provides full-screen, NTSC frame rate output at on a television monitor.—Roderick A. Beltran

Hassle-Free PC Security

If you keep confidential data on your PC and you're worried about intruders getting hold of it, consider the \$179 **Ensure XyLoc**, from Ensure Technologies (734-668-8800, www.ensuretech.com). This device consists of three components: a radio-frequency transmitter that plugs into your keyboard port, an electronic key that you carry with you like a remote car lock, and proprietary workstation software. When you move out of the transmitter's range, the screen blanks and the keyboard locks, preventing others from tampering with your data and seeing what's on-screen. When you return,

the screen immediately flips back to what you were doing. You can set an override password in case you lose the key; replacement keys cost \$89.99.—Josh Levy



Cloning workstations
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Why spend hour after hour, day after day cloning workstation after workstation when you can install a full 250MB Win95 system on a workstation in just five minutes using Ghost Software.

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HPFS, UNIX and Novell, and works with both SCSI and IDE devices. What's more, the Ghost Multicast version features "single transmission" technology which reduces network overhead when cloning multiple workstations.

It's easy to see why over one million seats have been sold to computer manufacturers and configuration centers, government agencies, universities, and more than half of Fortune 500 corporations.

See for yourself why Ghost is the ultimate system installer and recovery tool for Win95, WinNT and OS/2 workstations. Visit www.ghostsoft.com to download Ghost for a free 30-day trial. Or purchase it today and get one year of free upgrades and 90-day technical support. After all, life's too short to spend cloning workstations.

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HUMAN-RESOURCES TOOLS

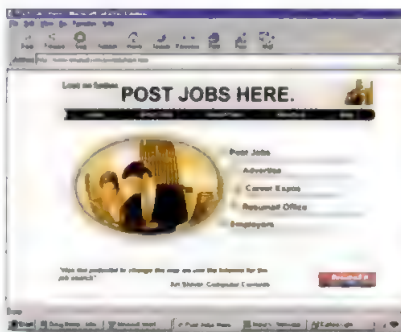
Employee Benefits

The Internet can be a boon to employers in helping find and manage a company's staff. New services are springing up to help human-resource professionals find the perfect job candidate and simplify human-resources administration.

Resumail Network (www.resumail.com) assists job seekers and hiring companies alike by providing a continually updated database of jobs and résumés. Employers can post job listings on the network with a \$495 one-year subscription, and job seekers can search the service for free. The service's software, **Resumail**, lets job candidates prepare résumés and deliver them in a database-friendly format. Employers receive the standardized résumés

with **Resumail Office**, software that can also send automatic responses to job seekers, locate résumés by keyword, sort résumés by search criteria, and share them across the enterprise or Internet. Resumail Office is available as a free download from the Web site.

Over at **CareerWeb** (www.careerweb.com), you can post professional, technical, and managerial openings in the site's job database. The service also provides resources for employers, such as tips on how to write effective job ads and company profiles; you can also hold a virtual career fair and interview candidates online. Employers can post



WORKER RELIEF: Resumail Network aids both job seekers and hiring companies.

a single job listing for \$135 per month. For \$7,500 per year, companies can post unlimited job listings and get a profile page and ac-

cess to the résumé database.

Targeting small to midsize companies, **Employeease** (www.employeease.com) simplifies human-resource and employee-benefits administration by placing employee information on a secure network over the Internet. Users access the database-driven system via a Web browser; the service lets companies centralize and standardize the maintenance and administration of employee information. The one-time setup fee is \$250 per administrative user and \$5 per employee; subscriptions are \$1 to \$4 per employee per month.

—Carol Mangis

WEB-BASED CONFERENCING

Presentations on the Fly

You can't always fly around the country to show off your latest and greatest PowerPoint presentation. Now you can use the Web instead of hopping on a plane. Two new services promise to de-

scribe of multimedia Internet presentations by providing features such as voting, group Web surfing, and individual and group messaging via any Web browser. E-Conference is available to anyone with an Internet connection, a separate phone line, and a PC running Microsoft Windows 3.1, 95, or NT. Pricing is \$1.60 per person per minute, including technical support and audio.

Taking a more traditional approach is **Astound** (800-982-9888, www.astound.com), whose \$150 **Astound 5.0** lets you import PowerPoint 97 files and export files in HTML for delivery via the Web. Version 5.0 also introduces new 3-D effects, Java-based conferencing, and the opportunity to insert artistic enhancements such as rotation, extrusion, and dynamic HTML.

—Stephanie Lindenbaum



JUST LIKE BEING THERE: Group Web surfing and messaging with E-Conference.

liver live Web presentations, meetings, and conferences using just a Web browser.

E-Conference's eponymous Web-based presentation service (303-786-8789, www.e-conference.com) is designed to ease the has-

WEB SITES

Going to the Chapel

No one wants to spend another wedding season trudging around crowded department stores and waiting in line to buy the last, most expensive gift on a couple's wedding registry. One of these online gift registries can help streamline the process of selecting and buying gifts.

The **WeddingChannel** (www.weddingchannel.com) is an interactive retail-shopping service and gift registry that lets couples post gift selections and lets wedding guests purchase those gifts online. Brides and bridegrooms choose from thousands of products in the site's virtual storefront, browsing by department or searching by product feature (such as manufacturer, color, or category). Guests then access the couple's personalized "Our Wedding" page to purchase gifts online.

From Internet Gift Registries comes **The Wedding Network** (www.weddingnetwork.com), an online retail catalog and bridal registry published in partnership with *Modern Bride* magazine. Couples select items from a list of online retailers. Guests view photos of the selected gifts on the



WEDDING BELLS AND BAUBLES: Register and buy wedding presents online at the Wedding Channel.

registry and purchase them from the Web site.

American Bridal Registry (www.abregistry.com) lets couples use their favorite catalogs, stores, and shopping services to maintain an online registry. You can select gifts off-line or with a provided list of traditional wedding-gift manufacturers, gift shops, wedding services, and Internet malls. Brides and bridegrooms supply the site with ordering information for gifts listed in the registry, and guests place orders by phone. To keep the registry current, buyers must inform the site of their purchases as they make them.

—Emily Cohen

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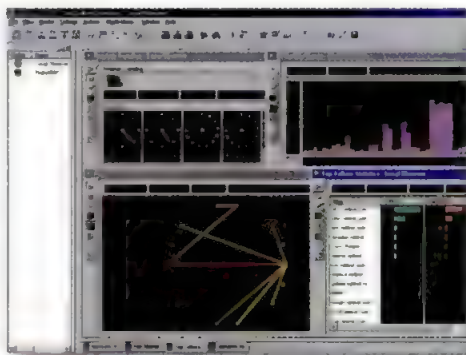
LAN ANALYSIS TOOLS

The Right Tool for the Job

As your network grows in size and complexity, having the right tools on hand to make sure that your network stays up and running is important. A network analyzer application is one of the must-haves in your network toolbox.

The newly debuted **Distributed Observer 5.0**—from Network Instruments (800-526-7919, www.networkinstruments.com)—includes all of the features of the original Observer.

Such as full-packet capture and decoding, long-term trending, and graphical network mapping. New to this version, as its name implies, is the ability to monitor remote network segments. The price of the base application and a single



SEGMENT WATCH: Network Instruments' *Distributed Observer 5.0*.

probe runs to \$995; each additional probe is \$295.

Using Distributed Observer, you can manage and troubleshoot up to 252 segments on your network. Another new feature is Network Observer's new GUI.

Previously, the product would let you have only one window open at a time. Now you can have multiple windows open concurrently, so following a number of reports is much easier.

Triticom (612-937-0772, www.triticom.com) has also recently revised its **LANdecoder32**. Priced at \$1,995, Version 2.0 is a software-based protocol analyzer that can operate in 10/100 Ethernet and 4/16 Token-Ring environments running Windows 95 and Windows NT.

Among the major improvements Triticom has added is a frame transmitter, which lets you generate

RECAP The last time we reviewed LANdecoder32 and Observer was in *NetTools* From the Bench, in the issue of November 4, 1997.

network traffic in order to diagnose network problems. LANdecoder32 also publishes the network's health statistics in HTML format. The data can then be posted on your intranet or the Internet for remote viewing.

Hopping on the improved-interface bandwagon, Triticom included drag-and-drop functionality in LANdecoder32's updated interface. Now, instead of constantly reentering important data from one report to another, you can move it with a simple mouse click.—Robert Daly

PRODUCTIVITY TOOLS

Minding Your Business

In the best of all possible worlds, employees would come to the office and put in a fair day's work for a fair day's pay, but we don't live in a Panglossian world. Too many times, a quick surf of the Internet can steal anywhere from 5 minutes to half an hour of productive time. Over time these little surfing safaris add up.

Knowing the importance of lost time, Elron Software (800-767-6683, www.elronsw.com) has re-

leased **Elron Internet Manager 4.5**. It starts at \$995 list for a 50-user license.

This new version adds several enhancements, including a new control console called the Alert Messaging Center. This Web-based GUI lets you configure custom alerts, so that you'll know when network users surf the Web past a specified amount of time or visit inappropriate Web sites during business hours. These alerts can be delivered by e-mail in addition to appearing on the Alert Messaging Center.

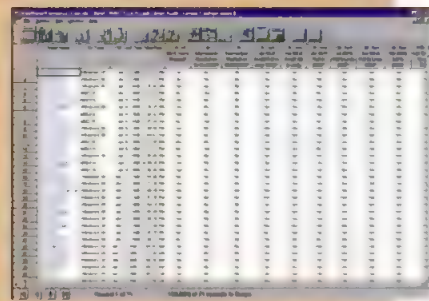
Also new are the SurfTime Meter and Report Wizard. SurfTime Meter determines the duration of Internet usage and helps you to put an actual dollar amount to the lost revenue based on each incident. The Report Wizard lets you tailor reports

Are You Ready to Y2K?

As the turn of the millennium comes closer, the chants of the Y2K doom-sayers become louder. You might associate this bug with just the COBOL-based applications running on the mainframes buried in the bowels of the financial industry, but more than likely one or more of the applications running on your network is not year 2000-compliant.

BindView Development Corp. (800-749-8439, www.bindview.com) has included a Y2K assessment feature in its **NETInventory 5.2** (\$1,775 for a 100-user license), which is a plug-in for the management console BindView/EMS (\$1,995 for a single console). Besides performing its normal network inventory function, NETInventory checks your PC's software against a database of over 4,000 known Y2K-compliant applications. It also checks every client's BIOS and real-time clock (RTC) with 16 different tests for year-2000 compliance every time a user logs on to the network.

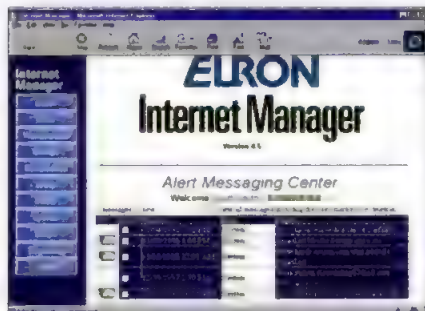
The product comes with a database that stores information about the detected noncompliant applications. Administrators can use a handy mail-merge utility to paste this data into a form letter to vendors requesting year-2000 compliance information about their products.—RD



based on individual need.

Charles River Media (800-382-8505, www.charlesriver.com) takes a different tack when it comes to monitoring employees. Instead of using a list of banned sites, which requires constant updating, the company's **Internet Watchdog 2.0 Enterprise Edition** (\$100 list for 1 to 10 users; \$500 list for a 100-user license) lets users access what they want but takes random screen cap-

tures throughout the day, as well as automatically recording all downloaded graphic files. By using this method, you can not only monitor how your employees are using the Internet but also see whether they're running any nonbusiness-related applications locally on their systems. Internet Watchdog 2.0 is available for NetWare, Unix, Windows 95, Windows 98, and Windows NT.—RD



RED ALERT: Elron Internet Manager informs you of Internet activity violations.

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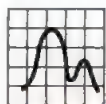
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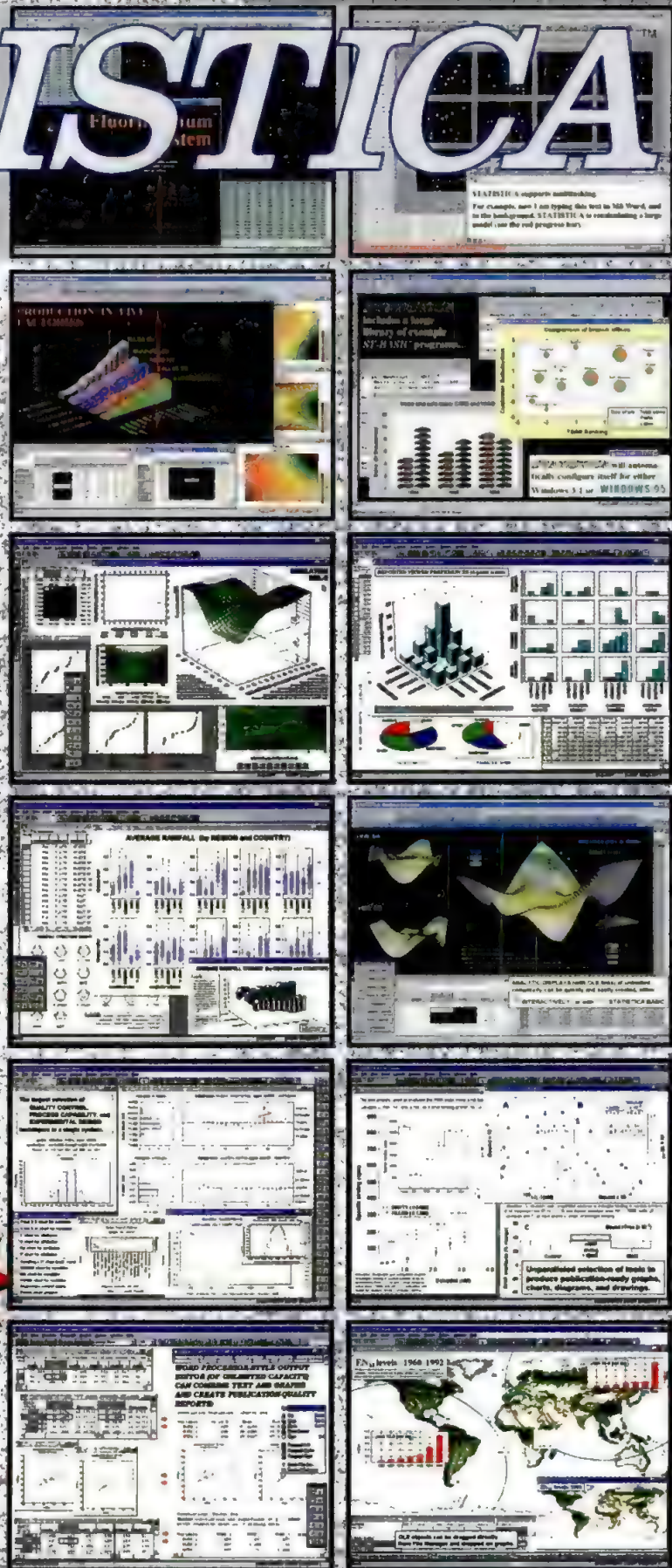
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17"	VisionMaster Pro 17 (15.9" VIS)	0.25mm/AG	92khz	1600 x 1200@74hz	\$579
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First Looks



INSIDE

PLUG IT IN:

The Adobe Photoshop plug-in specification paves the way for the six third-party applications, reviewed on pages 60 and 61.



NEW RECOGNITION:

VXI's Parrott and Philips' SpeechMike make voice recognition a whole lot easier. For the reviews, see page 64.

FLASH FLOPPY:

The Olympus FlashPath floppy disk adapter enables you to transfer digital images to your PC.

See page 68.



Windows CE 2.0 Cornucopia

New hand-held and palm-size PCs up the personal digital assistant ante with broader choices for productivity, reference, and communications.

By Bruce Brown

The days of look-alike Windows CE devices are ending. By early summer, an increasingly diverse lineup of Windows CE 2.0 companion PCs will be available in two of the three announced Microsoft reference design categories: hand-held PCs (H/PCs) and palm-size PCs (P/PCs).

The first shipping products in the third reference category, the Auto PC (A/PC), won't appear until the end of the third quarter of this year. And then there's the as-yet unannounced larger-size PC Companion reference design—code-named Jupiter—which is expected to rival lightweight notebook PCs. You may see the first systems by late summer or early fall of this year.

LOOKING BACK...AND FORWARD

Last year's Windows CE 1.0 H/PCs had to prove themselves against entrenched competition in a tough market. Primarily, they were competing against the wildly successful PalmPilot—the newest iteration of this product is dubbed the Palm III—arguably one of the only major success stories in the hand-held market up to that time.

The first of the CE 1.0 units were nearly identical, which worked for them as well as against them. Similarity may be good for an emerging standard, but it ultimately limits buyers' options. The new Windows CE 2.0 H/PCs and P/PCs, however, give you many more choices. You can select the companion PC that you want based on your preferences and specific needs.

Although there are less PC-centric Windows CE devices, such as golf carts and refrigerators, that will be coming with embedded processors in the future, today's new H/PC and P/PC products have a clear place and case for business, professional, personal information, and communication applications.

A SPECTRUM OF CHOICES

Although both the palm-size and larger hand-held Windows CE personal digital assistants (PDAs) can each be used as a standalone small personal computer, the major role of each is as a companion device. Each one is intended to be paired with a host PC, with which it can automatically synchronize personal information via serial cable or infrared connection. The two currently

More Products Reviewed ...

L&H Voice Xpress Plus.....	56
HP Printer/Scanner/	
Copier 380	68
EndNote 3.0	73
ProCite 4.0	73
SkyMap Pro	76
RouteFinder GPS for	
Windows 95 2.0	76

First Looks Online

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First Looks

available types of devices break out by size and function: The smaller-format P/PCs are for reference and taking notes; the larger but still compact H/PCs are for additional productivity and communications.

For this roundup, we tested the first three P/PCs on the market, as well as three of the newest H/PCs. All of the models will be shipping by the time you read this or shortly thereafter. In the P/PC category, we looked at a production line sample of the Casio Cassiopeia E-10 (\$400 street); and near-production versions of the Everex Freestyle (three different models, \$330 to \$500 street), and the Philips Nino 300 (two versions, \$400 to \$500 street).

You'll pay more for an H/PC device—but you'll also get more. Here, we review the Hitachi HPW-200EC (\$900 list), the NEC MobilePro 750C (\$900 street), and the Novatel Contact (\$1,000 street). Both the Hitachi and Novatel systems were tested in almost final versions; the NEC was a final market model from the first manufacturing run.

P/PCs: ONE-HANDED COMPUTING

If you want the smallest device that you can get for handwriting or voice-recording short notes and storing information about contacts, tasks, and appointments, the palm-size P/PC is the PDA for you. Just think of them as Windows-centric PalmPilots with voice recorders. These devices weigh from 5 to 7 ounces, measure roughly three-quarters of an inch thick, 3.3 inches wide, and about 5 inches deep, and come with 4MB to 8MB of RAM and 8MB of ROM. The operating system and standard applications are all stored in ROM, leaving RAM available for user-added applications and data.

Each P/PC has an integrated microphone and speaker with a standard voice recorder. Designed for use with one hand only, these devices have buttons on the front and on one or more sides (depending on the model), and

all have at least one integrated handwriting recognition program, in addition to an on-screen, pop-up keyboard. Like H/PCs, each P/PC has an infrared transceiver and a serial communications port. P/PCs also include standard docking cradles with serial cables for synchronizing data with host PCs.

Microsoft's reference design requires CE devices to have a CompactFlash slot, initially intended for memory and BIOS upgrades. In fact, all P/PCs currently on or near-ready for the market have larger, Type II CompactFlash slots to accommodate upcoming thicker CF cards that will function as modems, pagers, and next year, even tiny hard disks.

The monochrome, backlit, four-shade P/PC display has a resolution of 240 by 320 pixels, and measures 2.3 inches wide by 3.1 inches high, or 3.9 inches diagonally. The whole screen is available for application display, unlike 3Com's Palm devices, each of which have an identical-size display but reserve the lower three-quarters of an inch as an input area. Also, Palm devices support only 160-by-160 resolution.

Seeking higher resolution on a small screen may seem like a self-defeating endeavor. But in an impressive demonstration of what can be done on a small screen, the standard P/PC calendar application has a 12-month display mode that shows the entire year at once. To access a day-view screen, just tap on a given date.

Standard Microsoft applications for the P/PC platform include Windows CE OS 2.01, Windows CE Services 2.1, Pocket Outlook (calendar, tasks, and contacts), Inbox, Note Taker,

Voice Recorder, World Clock, CIC's Jot handwriting recognition software, Solitaire, and a calculator.

A standard application, Channels, is used for off-line Web browsing. Content is downloaded from special Mobile Channel content providers such as MSNBC. But to use this feature, you must have Internet Explorer 4.0 on your host PC; content is downloaded onto the host and then copied to the P/PC during synchronization for later browsing—a good way to catch up with the

With automatic synchronization, if you work on a standard PC with a P/PC in its docking cradle, any changes you make during the day on your calendar, task list, or contact manager are automatically copied to the P/PC as they are made. Whenever you leave for the day or go to a meeting, you just lift the P/PC from the cradle and the data on stored therein is current.

While you're away from your desk, any updates or additions that you make are likewise transferred to the host PC as soon as you put the P/PC back in its dock. This feature synchronizes automatically with Microsoft Schedule+ 7.0a, Microsoft Outlook 97 and Outlook 98, and the Microsoft Exchange client. Third-party software is available to enable synchronization with other PIMs.

With so much in common, you're probably wondering what differentiates one P/PC from the next. The three we review here are indeed generally similar but vary in action and placement of the controlling buttons. The differences are also in the design of their respective docking cradles and in the bundled bonus software.

Casio Inc.

Casio Cassiopeia E-10

The Casio Cassiopeia E-10 P/PC stands out from the crowd with its silvery gray, industrial-design-style case. The unit has four buttons on the bottom front of the case, below the screen: a power/backlight button, and function buttons for the Calendar, Contact, and Task applications. The remaining control buttons on the left side of the unit include an Action button with a roller dial for item selection, an exit button, and a button to start the voice

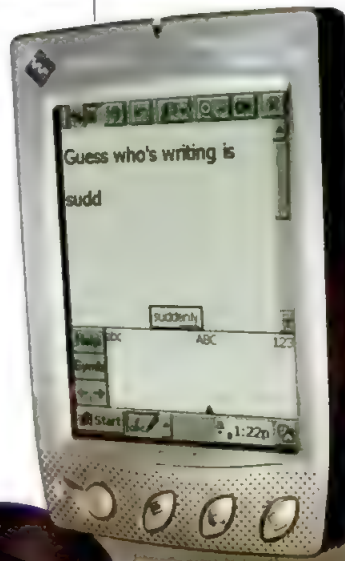
Casio Cassiopeia E-10

Street price: \$400

Casio Inc., Dover, N.J.;
800-962-2746; 973-361-5400

www.casio.com

Choose 413 at
www.pcmag.com/infoclink



ACTION! The Cassiopeia's side-mounted Action button lets your scroll through and select items on-screen.

news or other content during a commute or daily walk.

You have three major options for synchronizing data between a P/PC and a host PC. You can activate synchronization manually, start automatically on connection, or set synchronization to monitor connected devices and update information that's out of date. In the latter case, data that is changed on either the host or CE device is updated automatically on the other system.

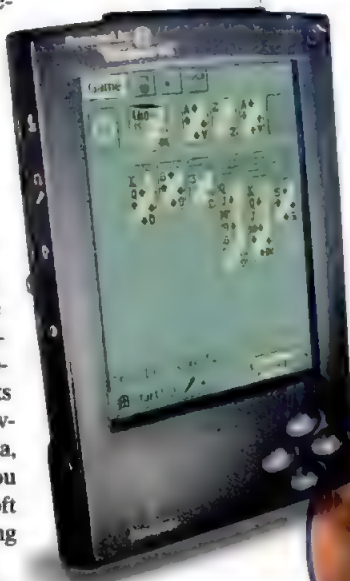
recorder. The E-10 also has an earphone jack so you can listen to voice notes in privacy.

Powered by a 66-MHz NEC VR4111 CPU, the E-10 has 4MB RAM, which is expandable via the CompactFlash slot. The two-piece docking cradle has a dark-gray base and a removable, clear plastic upright support. We found that the support piece really isn't necessary; removing it makes the base easier to pack for travel. The E-10 weighs 5.5 ounces and measures 0.7 by 3.2 by 4.9 inches.

As the only shipping model of the P/PCs tested here, the Casio is the best representative of how well handwriting recognition, voice re-cording, and application synchronization works in the product category. Whenever you want to enter or edit data, a tap on the task bar lets you choose between the pop-up soft keyboard or the Jot handwriting recognizer.

The Jot recognizer works with natural keystrokes or with one-stroke characters. A quick online reference demonstrates how to create characters correctly. A 14,000-word dictionary tries to anticipate the words that you are writing, with pop-up selection options for quick word

completion. The standard version of CIC's Jot uses a limited part of the screen for input, but a full-screen version is available for \$24 via the company's



Web site (www.cic.com). Whether you use single-stroke, Graffiti-like characters, or more natural multi-stroke letters, Jot works quickly and well.

The voice recorder is a handy convenience, with

Everex Freestyle

List price: \$329 (4MB); \$399 (8MB); \$499 (8MB w/modem)

Everex Systems, Inc., Fremont, CA; 888-725-6724; fax: 888-725-6329; freestyle.everex.com
Choose 414 at www.pcmag.com/infoclink.

each recording date and time stamped for quick perusal. There are a variety of recording codecs available, but the standard codec that is used compresses the sound to approximately 16 minutes per megabyte of storage.

Bonus software with the E-10 (provided on a CD-ROM) includes the SmART Commander command-and-control program, bFAX Express, LandWare's Financial Calculator, Tetris CE, Quicken Expensable, MeetingMinder, File Find Utility, and the Casio Digital Camera Viewer.

The E-10 is rated to run from 25 to 40 hours on two triple-A



RECHARGE IT: The Everex Freestyle comes with rechargeable batteries, plus an AC adapter.

alkaline batteries. Like all Windows CE palm-size PCs, the Casio unit also has a small, coin-size lithium ion battery as a backup. An AC adapter is not standard but is available as a \$20 option. The

company doesn't sell rechargeable batteries for the E-10, but the device will run on standard triple-A nickel hydride rechargeable cells.

Additional options for the E-10 include a 19.2-Kbps modem adapter that fits in the docking cradle (\$99), a variety of cases, replacement stylus (\$5.25), stylus/pen combination (\$10.50), and three CompactFlash memory cards (4MB, \$80; 8MB, \$130; 16MB, \$180).

Like the other P/PCs and H/PCs, the Casio is backed by a one-year warranty. Live technical support is available from 7:00 to 6:00, weekdays. Casio doesn't have a specific replacement or repair-time policy, but according to the company, it treats all service requests on an expedited basis for quick turnaround.

Everex Systems Inc.

Everex Freestyle

Two models of the Everex Freestyle will be on the shelves for sale by the time you read this. The Freestyle Associate A-10 model with 4MB RAM has a list price of \$329; the Manager A-15 with 8MB RAM is expected to sell for \$399; and the top-of-the-line Executive model (available in June) with 8MB and with a

SUMMARY OF FEATURES

Windows CE 2.0 PCs

PALM-SIZE HAND-HELD	Casio Cassiopeia E-10	Everex Freestyle	Philips Nino 300	Hitachi HPW-200EC	NEC MobilePro 750C	Novatel Contact
Price of tested configuration	\$400 (street)	\$329 (list)	\$400 (street)	\$900 (list)	\$900 (list)	\$1,000 (street)
Weight (ounces)	5.5	5.3	7.3	28.9	28.8	22.4
Size (HWD, inches)	0.7 x 3.2 x 4.9	0.7 x 3.2 x 4.8	0.8 x 3.4 x 5.3	1.3 x 10 x 5.2	1.4 x 9.6 x 5.4	1.2 x 7.6 x 4.7
Processor/speed (MHz)	NEC VR4111 / 66	NEC VR4111 / 66	Philips R3910 / 75	Hitachi SuperH-3 / 100	NEC VR411 / 80	Hitachi SuperH-3 / 80
Standard/maximum RAM	4MB / 4MB	4MB / 8MB	4MB / 8MB	16MB / 32MB	16MB / 32MB	8MB / 32MB
ROM	8MB	8MB	8MB	12MB	16MB	16MB
Battery type	Alkaline	Nickel hydride	Nickel hydride	Lithium ion	Lithium ion	Lithium ion
Number and size	2 AAA	2 AAA	2 AAA	1 proprietary	1 proprietary	1 proprietary
Rated life (hours)	25-40	20	10-12	10	8-10	8-12
Display type	4-shade gray-scale	4-shade gray-scale	16-shade gray-scale	256 color	256 color	4-shade gray-scale
Diagonal size, in inches/resolution	3.9 / 240 x 320	3.9 / 240 x 320	3.9 / 240 x 320	8.1 / 640 x 240	8.0 / 640 x 240	7.1 / 640 x 240
Modem speed (Kbps)/type	19.2 / In cradle	33.6 / In cradle	19.2 / External	33.6 / Internal	33.6 / Internal	14.4 (wireless, 19.2) / Internal
Standard or optional	Optional	Optional	Optional	Standard	Standard	Standard
Expansion	Compact Flash Type II slot	Compact Flash Type II slot	Compact Flash Type II slot	PC Card Type II slot, Compact Flash slot	PC Card Type II slot, Compact Flash slot	PC Card Type II slot, Compact Flash slot
Repair or replacement turnaround policy	Varies	72 hours	72 hours	72 hours	72 hours	Depends on reseller

First Looks

33.6-Kbps modem in a folding docking cradle will sell for \$499. Our test system, the Freestyle Associate A-10, weighs 5.3 ounces, and measures 0.7 by 3.2 by 4.8 inches, making it the lightest and smallest of the P/PCs.

The Freestyle Associate is the least expensive P/PC here, but it doesn't come with a docking cradle. A serial cable for direct connection is included, however, as are rechargeable triple-A nickel hydride batteries and an AC adapter/charger. Depending on the type of activity and backlight use, a full charge is rated at up to 20 hours of continuous use. The Manager and Executive models each come with a folding cradle for packing convenience; the cradle with the Executive model includes the modem and has an additional battery compartment (also available in the Manager) to power the modem.

This unit has four application buttons in a diamond pattern on the front of the case, with the Action and recorder buttons on the left side. A feature unique to the Associate is a standard internal vibrator, which can be set to alert—along with a visible light—when signaling upcoming appointments. A natural application is to use P/PCs as pagers (with third-party CF pager cards expected soon); with its standard vibrating alarm mode, the Associate has a lead on other products in this roundup. Another unique feature is a combination earphone/microphone jack for use with a headset.

In addition to the standard Windows CE software, the company bundles Microsoft Outlook 98 with the Freestyle models. Options include the folding cradle (\$49.99 list), cradle with modem (\$169.99), 4MB memory upgrade (to the maximum 8MB, \$129.99), extra rechargeable batteries (\$19.99), AC adapter (\$24.99), serial cable (\$19.99), and stylus three-pack (\$9.99).

Everex backs the Freestyle

Associate with a one-year warranty. Live technical support is available from 11:00 to 9:00 weekdays, and the company offers a 72-hour repair or replacement policy.

Philips Mobile Computing Group Philips Nino 300

Philips Mobile Company Group continues the style-setting stance it took with the Philips Velo H/PC with the Nino 300—the sleekest of the first batch of Windows CE P/PCs. Two versions will be available: one with 4MB RAM for \$400 and the other with 8MB of RAM and a clip-on 19.2-Kbps modem for \$500. The tested 4MB version was a preproduction model but had a finished case.

At 7.3 ounces and measuring 0.8 by 3.4 by 5.3 inches, the Nino is the largest of the first three Windows CE P/PC models. Except for the power button, which is on the lower front of the case, all application and control buttons are on the two sides of the device. The Nino's case is a combination of light silvery colored metal with black rubber side pieces. The middle of the case is tapered, which both looks good and makes the unit easy to hold. Although the Nino is longer than the Casio and Everex models, in practice the extra length has a practical result, giving you a place to rest your palm if you use the stylus for writing on the screen.

The Nino's standard ovoid docking station has an attached cable for serial connection to a host PC. Rechargeable triple-A nickel hydride batteries are also included,

with a 10- to 12-hour rating (depending on usage), along with an AC adapter/charger.

An application unique to this system is Pocket Commander, which trains the Nino to respond to commands to launch applications. In addition to the standard soft keyboard and Jot handwriting recognizers, the Nino also comes with a T9 embedded soft keyboard, a technology used with some telephones that enables using just a few on-screen keys for data entry. Other standard software includes Nino

Philips Nino 300
Street price: \$400 (4MB);
\$500 (8MB w/modem)
Philips Mobile Computing Group,
Campbell, CA;
888-275-8358, 415-558-2200;
nino.philips.com
Choose 415 at
www.pcmag.com/infoclink.

Converter, smART Writer, Pocket Commander, and Expense Manager.

Options for the Nino include the modem (\$90), Nino



Dock (\$40), Nino-to-PC traveling cable (\$30), traveling AC adapter (\$35), rechargeable battery pack (\$40), car charger (\$20), and Compact Flash memory cards (pricing was not available at the time of our review).

Philips supports the Nino with a one-year warranty, 9:00 to 3:00 weekday live technical support, and a 72-hour repair or replacement policy.

H/PCs: TWO-HANDED PRODUCTIVITY

H/PCs look like slightly shrunken traditional notebook PCs, with clamshell displays and real keyboards. Earlier this year, the first Windows CE 2.0 H/PCs appeared from Hewlett-Packard, NEC, Philips, and Sharp. The first color displays came with the HP 620LX and Sharp Mobilon HC-4500; the first "wide-body" model with a more typist-friendly keyboard and wider screen came about in the NEC MobilePro 700.

The newest H/PCs from Hitachi Home Electronics, NEC Computer Systems Division, and Novatel Wireless join the ranks of earlier Windows CE 2.0 H/PCs, differentiating themselves with larger color screens and the biggest keyboards yet on the Hitachi HPW-200EC and NEC MobilePro 750C. A communications double-header can be had with the Novatel Contact, which integrates both a cellular digital packet data (CDPD) wireless modem and a fast landline modem.

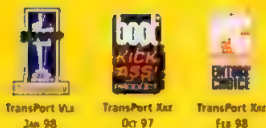
The Hitachi and NEC models give you the ability to create and edit information relatively comfortably, and with their integral VGA ports and modems, they offer a convenient way to run presentations and communicate with the office. Novatel takes communications a big step further—even away from phone lines—making the Contact the ultimate hand-held for people who need to be connected at all times.

Current H/PC models vary more than P/PCs. The three H/PCs in this roundup weigh from 22 to 29 ounces; and measure 1.2 to 1.4 inches high, 7.6 to 10 inches wide, and 4.7 to 5.4 inches deep. They include 8MB to 16MB of RAM, and all three models are expandable to 32MB. The internal screen resolution is 640 by 240 (also known

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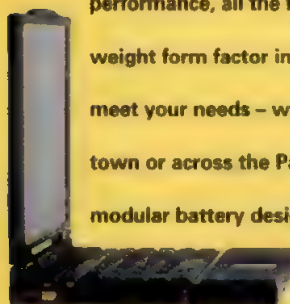
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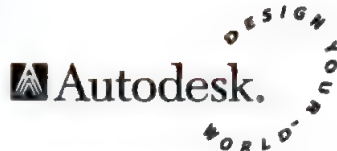
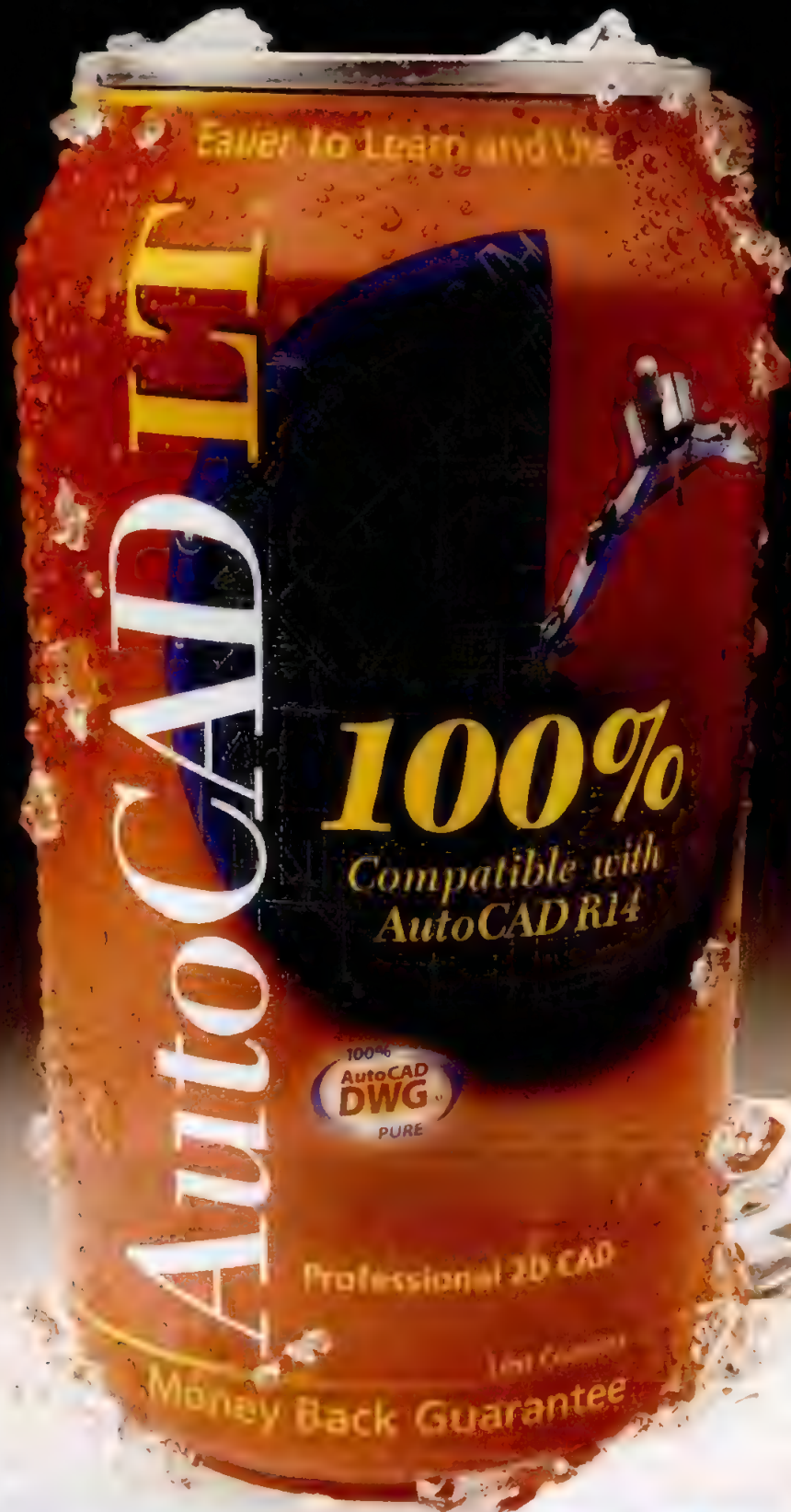


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December 2, 1997
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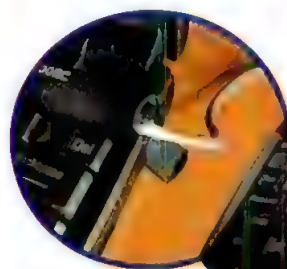
as half-VGA), on screens that measure from 7.1 inches diagonal (Novatel) to 8.1 inches (Hitachi).

Powered by proprietary lithium ion battery packs, the three new H/PCs each have rated battery lives of 10 to 12 hours, depending on use, which in the case of the Hitachi and NEC will vary by use of the backlight; and with the Novatel model, with the amount of use of the wire-

H/PCs have VGA-output display potential, but only when using Pocket PowerPoint. Not all H/PCs have standard VGA ports, though single-purpose or dual-purpose jacks that support VGA output are included in the three reviewed units.

Hitachi HPW-200EC

List price: \$900
Hitachi Home Electronics (America) Inc., Norcross, GA; 800-241-6558; 770-279-5600; www.hitachi-ca.com
Choose #16 at www.pcmag.com/infolink.



COMMUNICATE: The HPW-200EC has an integrated 33.6-Kbps modem.

less modem as well as the display backlight. The three H/PCs also have one Type II PC Card slot and a CompactFlash slot.

H/PCs have a broad range of standard software, including Calculator, Pocket Internet Explorer, Pocket Outlook (which includes calendar, contacts, inbox, and tasks), Solitaire, Voice Recorder, World Clock, and a suite of applications known as Pocket Office, including Pocket Word, Pocket Excel, and Pocket PowerPoint.

Pocket PowerPoint enables H/PCs to serve as portable presentation machines, easily hooked to a portable LCD projector for the ultimate in presentation portability. PowerPoint presentations still need to be created on a conventional PC with the full-blown Microsoft PowerPoint application, but finished applications—including slides and notes—can be downloaded and converted to Pocket PowerPoint format for display on the H/PC screen or externally via a VGA-out port. All

Hitachi Home Electronics

Hitachi HPW-200EC

By just one-tenth of an inch in diagonal screen size, and 1-millimeter greater distance from key-center to key-center, the Hitachi HPW-200EC has just a barely bigger screen and slightly wider keyboard than the NEC MobilePro 750C. Our test system was a late preproduction unit, although shipping models will be in stores before you read this. The Hitachi is powered by a 100-MHz Hitachi SuperH-3 CPU and has 12MB of ROM.

The HPW-200EC weighs 28.9 ounces and measures 1.3 by 10 by 5.2 inches. The 17-mm key-center distance between its 74

keys is just 2 mm less than a standard keyboard. The keyboard is large enough; many people will feel comfortable

typing on it for a moderate amount of time. The only design compromise that is questionable is the location of the right shift key to the right of the

Up Cursor/PgUp key—the extra pinkie reach to hit the right shift key is an initial nuisance, requiring adjustment for people who use conventional keyboards.

The 256-color, 640-by-240 display on the HPW-200EC is very bright and very clear. Separate contrast and brightness adjustments provide a wide range of control. There is no backlight key to turn off the backlighting to conserve power, however. Using the 50 percent to 200 percent zoom capability in Pocket Word and Pocket Excel, you can get a lot of work done without feeling very constrained with the unit.

A single port on the Hitachi HPW-200EC does double duty as the VGA-out and serial I/O port, which means that you cannot have both types of connections simultaneously. The VGA-

out cable is not standard but comes as a \$69 option. Other options include an extra AC adapter (\$39), 16MB memory upgrade card (\$199), serial cable (\$49), rechargeable battery pack (\$79), and stylus two-pack (\$9).

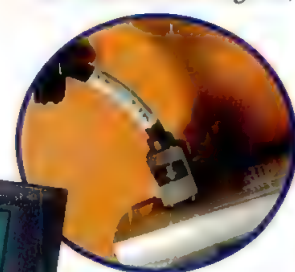
In addition to the standard Windows CE 2.0 H/PC software, the Hitachi comes with Hitachi Memo Pad and PC Screen Capture, bSquare bFAX Professional, Odyssey Computing BizCalc, Compuserve Sprynet, LandWare Pocket Finance, CIC Speller, and Microburst Virtual Courier. A one-year warranty is backed by 9:00-to-5:00 technical support and a 72-hour repair or replacement policy.

NEC Computer Systems Division

NEC MobilePro 750C

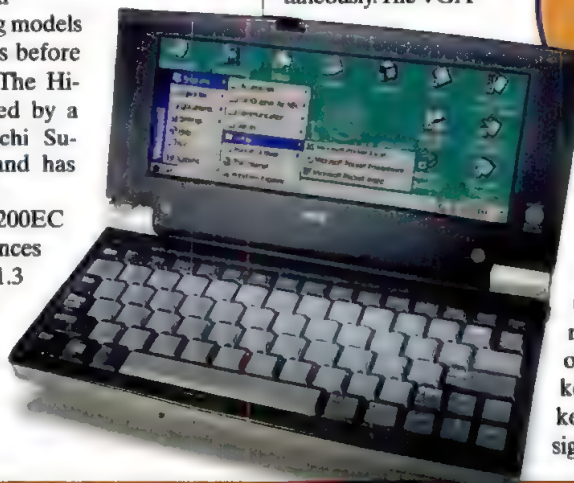
The NEC MobilePro 750C, which is similar in size to the previously introduced monochrome MobilePro 700, is another portable productivity companion. The silver-cased 750C is powered by a 80-MHz NEC VR4111 CPU and has 16MB of ROM. Weighing in at 28.8 ounces with batteries, this machine measures 1.4 by 9.6 by 5.4 inches. Our test unit, a production model with all systems functional, performed flawlessly.

At 8.0 inches on the diagonal,



PICTURE THIS: NEC includes a VGA-out cable with the MobilePro for presentations.

the 750C's screen is almost the same size as that of the Hitachi. Its 16mm key pitch for the 80-key keyboard is a single—but significant—millimeter less



First Looks

than the HWP-200EC's key pitch. The unit's keyboard arrangement doesn't suffer from the remote right shift key found on the Hitachi model, making up for the slight difference in key pitch by a more natural reach for the shift key. The MobilePro also has two Alt and two Ctrl keys, unlike the Hitachi which has only one of each.

The NEC screen has contrast control keys and a backlight mode key to select normal and full backlighting. On a test on an airplane, the screen was sufficiently bright with the backlight on low-power mode. According to the manual, running at full backlight mode consumes battery power at twice the rate of normal mode.

The NEC MobilePro 750C has separate serial I/O and display ports, and the VGA-out cable is included as a standard accessory. Options for this system include an extra AC adapter (\$34), serial cable (\$14), VGA cable (\$19), rechargeable battery (\$69), stylus three-pack (\$6), and leather carrying case (\$29). A 32MB RAM upgrade costs \$299, but requires discarding the standard 16MB card, which makes upgrading more costly than one would expect.

NEC also bundles an impressive amount of bonus software with the MobilePro 750C, including bSquare bFAX and bPRINT, Paragraph CalliGrapher for NEC, JetForm Filer Pro and Filer Centra, Compuserve Sprynet, Puma Intellisync, Symantec PC Anywhere, CIC QuickNotes, M-Systems TrueFFS, and Microburst Virtual Courier.

The NEC one-year warranty comes with two features unmatched by the other vendors: 24-hour live technical support and 72-hour door-to-door repair or replacement of a defective unit. A three-year UltraCare warranty extension for \$85 is a bargain.

Novatel Wireless Inc.

Novatel Contact

If you must stay in touch all the time—a necessity for an increasing number of mobile workers—the Novatel Contact gives you that opportunity. Otherwise a fairly ordinary hand-held PC device with a 7.1-inch diagonal, four-shade monochrome backlit screen, the 80-MHz Hitachi SuperH-3-powered Contact charges to the front of the communications brigade.

Novatel Contact

Street price: \$1,000

Novatel Wireless Inc.,

San Diego; 888-888-9231,

800-675-2638;

www.novatelwireless.com

Choose 418 at

www.pcmag.com/infolink.

currently in great flux, although monthly flat rates comparable to landline ISP rates are expected as business grows and service expands.

To connect to the Internet via the Contact's wireless modem, you simply tap on the Contact Modem Connection icon on the Windows CE desktop. The modem first connects

with the wireless carrier and then launches Pocket Internet Explorer. From there, you can surf the Web or download information from

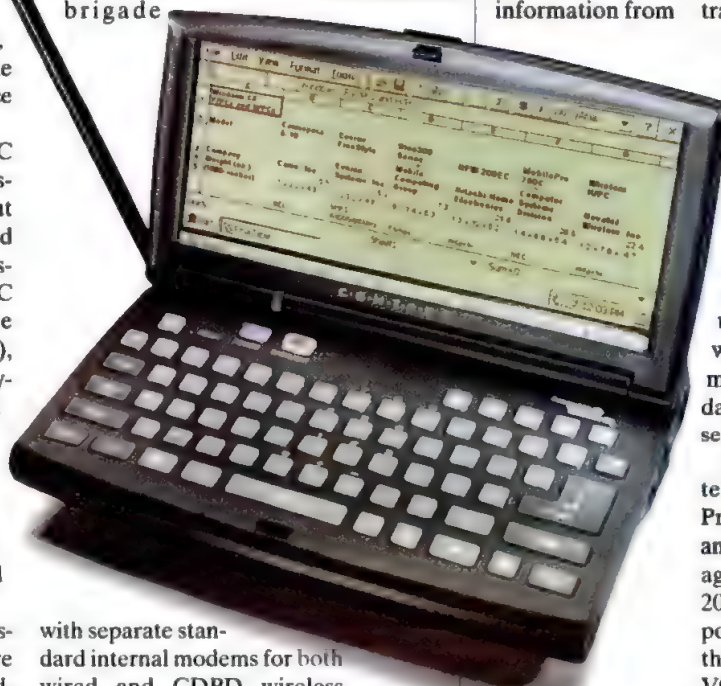
ceive e-mail. And you can do all of this while you're away from AC power and conventional phone lines.

At 22.4 ounces, the Contact is relatively light compared with the larger Hitachi and NEC models; the unit's dimensions are also more compact at 1.2 by 7.6 by 4.7 inches. The AC adapter, on the other hand, is surprisingly large at 1.25 by 2.2 by 3.75 inches, which is similar to or larger than the dimensions of many full-size notebook PC adapters. This AC adapter adds another 10.4 ounces to the Contact's total weight.

The monochrome blue-green screen is reasonably visible, with a backlight button on the keyboard and contrast controls on the lower margin of the display itself. The Novatel's small chiclet-style keys are placed close enough together that you'll want to avoid using this unit for lengthy writing or data input. For remote editing, note-taking, and data entry, however, it will serve fine.

Software bundled by Novatel includes bSquare bFAX Professional, bSquare View, and the Wireless Modem Manager. Like the Hitachi HPW-200EC model, the serial I/O port on the Contact doubles as the VGA-out port; again, the VGA-out cable is optional. No option prices were available at the time of our evaluation, but the option list will include the VGA-out cable, as well as an earphone/microphone combination (which use a single dual-purpose jack), cradle, stylus pack, DC car adapter, and a leather case.

Novatel will back the Contact with a one-year warranty and live technical support on weekdays from 11:00 to 7:00. Repair and return policies will be set by resellers, which in some cases may include wireless service carriers.



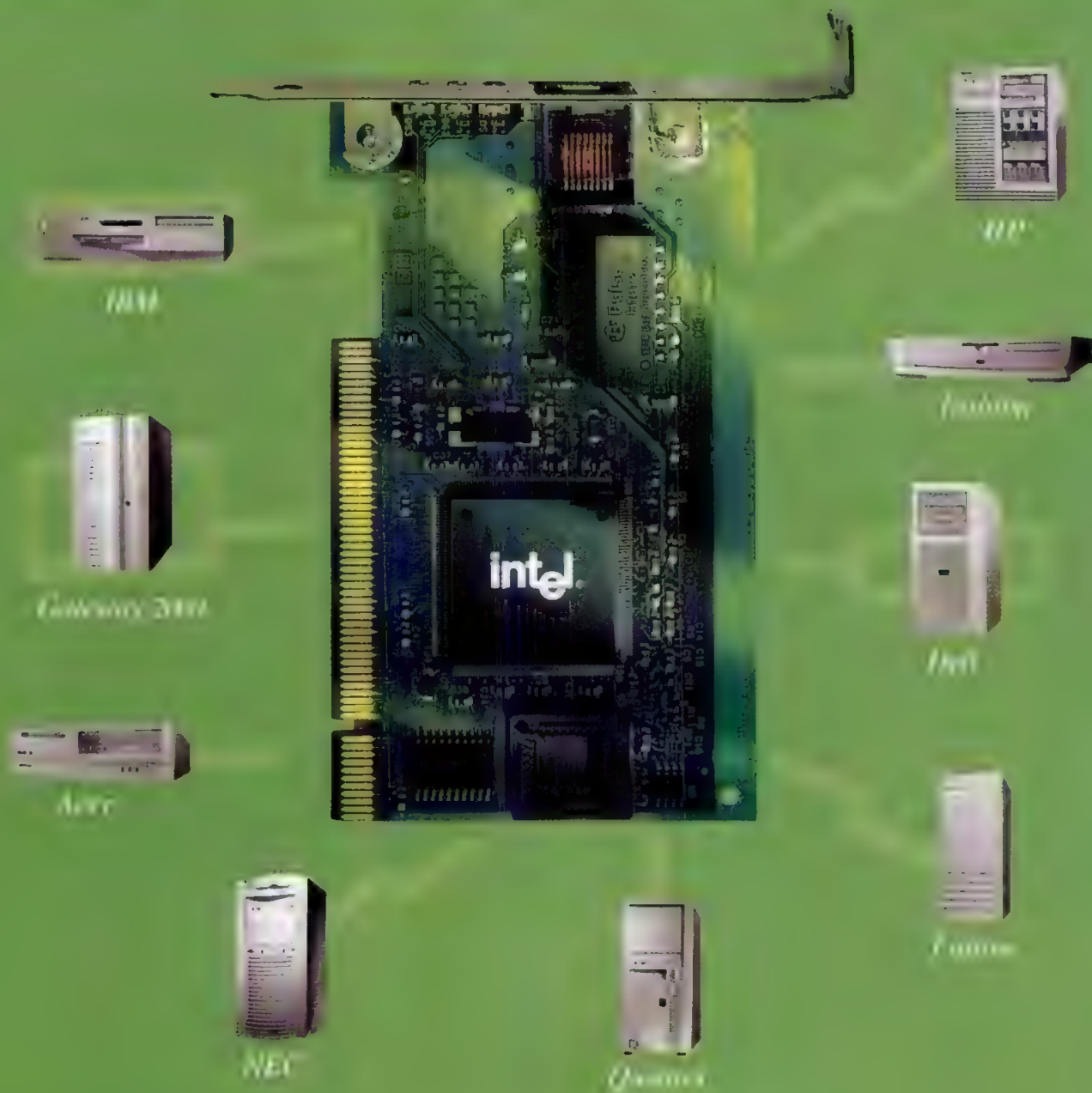
with separate standard internal modems for both wired and CDPD wireless communications. This unit is slightly more expensive than both the NEC MobilePro 750C and the Hitachi HPW-200EC, but you get a lot of bang for that extra 100 bucks.

Neither of the Contact's integrated modems is a speed demon: The wired modem is a 14.4-Kbps model, and the wireless modem has a maximum rate of 19.2 Kbps. To use the wireless modem, you'll need to subscribe to a CDPD wireless service, currently available in most but not all major metropolitan areas. Wireless rates are

information service carriers.

In testing, our preproduction test model was able to connect quickly and successfully to PC Magazine Online, although the very slow modem required patience when downloading a relatively graphics-rich Web site. The point, however, is that this portable device already brings you all of the productivity and connectivity benefits of the Windows CE H/PC platform—and then on top of that—also lets you browse the Web, download information, and send and re-

One way to judge an adapter is
by the people who use it.



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First Looks

VOICE RECOGNITION SOFTWARE

Just Say the Word

Navigate and edit your dictated documents with Voice Xpress Plus's intuitive voice commands.

By David Haskin

If you can't type—or don't like to—last year's new generation of continuous-speech recognition products was a boon. Although these products let you dictate documents in a natural voice, they were clumsy at editing and navigating documents.

L&H Voice Xpress Plus (\$100 street), the newest natural-language dictation product, largely succeeds at making editing and navigating documents as natural as dictating them. As with NaturallySpeaking from Dragon Software and IBM's ViaVoice Gold, however, getting up and running with Voice Xpress can be frustrating. (See page 64 for accessories that make voice recognition software even better.)

BASIC TRAINING

Just as with other programs, you first must train Voice Xpress.

You correct mistakes in this correction dialog box.

The first step is to use a wizard to configure the included noise-canceling microphone so that it operates optimally given the level of background noise.

Even after we used the wizard on our tests, however, Voice Xpress was sensitive to ambient room noise, providing particularly poor recognition when an old, noisy laser printer was running. We achieved satisfactory performance only after we turned off the printer and made lengthy experiments to find the appropriate sound level.

The next step is to read more than 400 phrases to teach Voice Xpress to work with your voice.

This took about an hour, with an additional 25 minutes to compile the training results into a voice-specific file. Our test PC was a 400-MHz Pentium II with 64MB of RAM; the vendor claims the compilation process can take as long as an hour on slower PCs.

After the setup process, we immediately dictated 100 to 110 words per minute with 85- to 90-percent accuracy. We conducted our tests reading from printed text, which produces the fastest

dictation results. You can dictate only into the included XpressPad

text editor and Microsoft Word, not into Corel Word-

language commands for navigating, editing, and formatting documents. Most of the commands are intuitively obvious (such as "move to the top of the document" and "delete this line").

You can state most commands in several ways: We got the same result saying "bold the next three paragraphs" and "make the next three paragraphs boldface." The only problem was remembering to pause briefly before switching between dictating to giving navigation and formatting commands. If you don't pause, the text of the commands will end up in the document.

Products like NaturallySpeaking require compound commands for navigation and editing. The Voice Xpress command is "delete the next two words," but NaturallySpeaking and ViaVoice require you to navigate to the words, then speak separate commands to delete them.

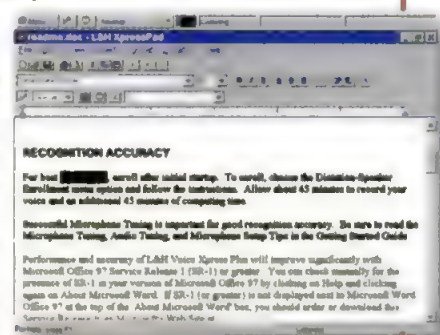
To highlight words for editing and formatting, other programs require a series of navigational commands to position the cursor, then a command to highlight the words. In Voice Xpress, you

highlight simply by saying "select" and then speaking the words you want to highlight.

After highlighting, you can dictate the word or say "correct that" to bring up a dialog box into which you can type or spell the new word. Unlike in ViaVoice and NaturallySpeaking, however, suggested replacement words do not appear in the correction box. When spelling (in any dialog box or in the document itself), you can speak letters naturally, saying "a" and "b" instead of using the alpha-bravo alphabet.

NOT QUITE PERFECT

In addition to the initial frustration of setting up Voice Xpress, other small annoyances arose. Even on our 400-MHz test machine, 5 to 10 seconds often

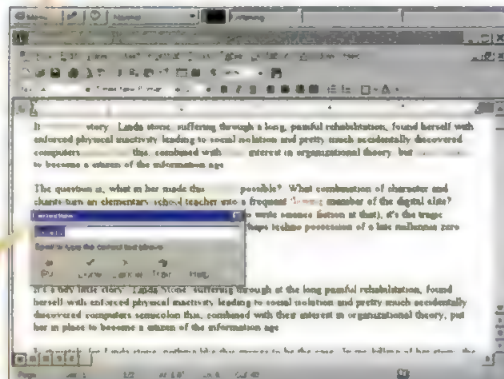


WITHOUT A WORD: Besides dictating into Microsoft Word, you can dictate into Voice Xpress's XpressPad text editor.

elapsed before dictated text appeared on-screen. The vendor said that such delays sometimes happened with early releases of Word but shouldn't occur in XpressPad, but we still experienced them often in XpressPad.

Voice Xpress also occasionally refused to recognize specific words, even after multiple training attempts. We trained the word "hello" eight times, for example, before Voice Xpress accurately recognized it. The program also demands intense resources, so although the product's price is low, many users will have to spend additional money to upgrade their computers.

Although Voice Xpress Plus can be frustrating at times, it is still the easiest voice recognition product we've used. The product is quite accurate at natural-language dictation, and its unique and intuitive voice commands significantly shorten the time spent learning how to use it. **L&H Voice Xpress Plus.** Street price: \$100. Requires: 48MB RAM, 130MB hard disk space, Microsoft Windows 95 or NT 4.0 or later. Lernout & Hauspie Speech Products, Burlington, MA; 800-380-1234, 781-203-5000; www.lhs.com. Choose 412 at www.pcmag.com/infolink.



TAKE A LETTER: Voice Xpress Plus lets you dictate directly into Microsoft Word.

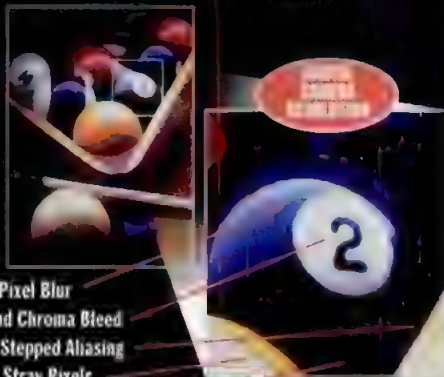
Perfect or any other application.

Our initial attempts at dictation were slow going, since they required correcting as many as 15 errors for every 100 words dictated. But Voice Xpress learns when you correct mistakes and becomes more accurate over time. After 2 hours, our dictation speed rose to about 115 words per minute; accuracy was about 95 percent, comparable to ViaVoice and NaturallySpeaking.

Voice Xpress Plus is superior to those applications because of its ability to handle natural-

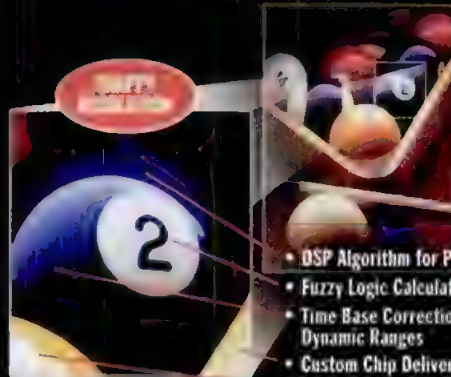
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How Is This Possible?

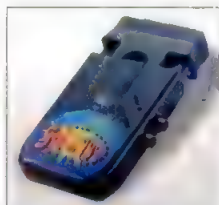
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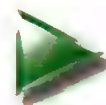
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First Looks

PHOTOSHOP PLUG-INS

Turn on the Cool Effects

These six inexpensive add-ins bring more useful features to your image-editing software.

By Luisa Simone

Adobe Photoshop, the leading image-editing program, is incredibly robust. Yet Photoshop can't meet every need of its large and diverse user base. Enter the Adobe Photoshop plug-in specification, which lets third-party developers extend the program's functionality with special-

multiple buttons simultaneously and arrange them in perfectly aligned rows and columns.

Creating realistic shadows manually in any image-editing program is a real chore. PhotoCastShadow not only creates a shadow instantly from any selection, it also lets you simulate perspective easily by skewing the shadow and adding a special blur to mimic depth of field.

Version 2.0 enhances PhotoText, a utility that now lets you save an editable, multiblock

ME AND MY: PhotoTools' PhotoCastShadow creates a shadow from any selection area. Manipulation handles make it easy to simulate perspective.

effect, import, and export filters.

The six products in this roundup add a variety of functions to Photoshop, including sophisticated typography, tools for optimizing Web graphics, and powerhouse effects. These products have a wide potential audience, because the Adobe specification has been adopted as a de facto industry standard. Many other image-editing programs can function as host programs to Photoshop-compatible plug-ins.

EXTENSIS PHOTOTOOLS

At \$130 (street) Extensis PhotoTools 2.0 is a bargain, because it's really a collection of seven different utilities. Brand-new to the product are PhotoButton and PhotoCastShadow modules. PhotoButton automates the creation of 3-D buttons for a Web site or multimedia presentation. It gives you control over every aspect of a button's appearance. PhotoButton can even generate

text layout in a proprietary format (PTX). You can define styles that use all the formats this utility supports, including advanced typographic attributes, and you can reuse type styles—and even explicit blocks of text—in multiple compositions.

All of the special-effect filters offer significant interface improvements. For example, the preview area can display a composite of all the layers in a document, so you can truly judge how an effect will look. And whenever you generate a shadow, a glow, or text, you can automatically create a new layer for it, making a composition easier to modify. You can even apply PhotoTools' special effects using sophisticated blending modes, such as multiply and lighten.

The only unchanged module, PhotoBars, is specific to Photoshop. It references all of Photoshop's commands, and it lets you

move to shortcut toolbar functions that are otherwise buried deep in menus.

PhotoTools isn't perfect. Creating a perspective blur for a shadow, for example, significantly slows down program operation. We'd also like to see more robust typographic formats, including indents, bullets, and alignment options (such as force justify). But these complaints are insignificant in the light of the program's ability to boost your productivity.

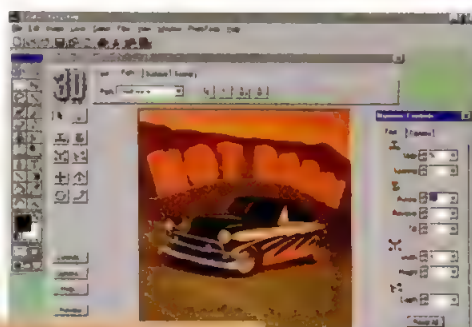
Extensis PhotoTools 2.0. Street price: \$130; upgrade, \$49.95 direct. Requires: Adobe Photoshop 3.0.5 or later or a host program that supports the Photoshop Plug-in 3.0 API, 16MB RAM, 3MB hard disk space, Microsoft Windows 95 or NT 4.0 or later. Extensis Corp., Portland, OR; 800-796-9798, 503-274-2020; www.extensis.com. Choose 408 at www.pcmag.com/infolink.

EXTENSIS MASK PRO

Both its price (\$300 street) and its tight focus on a single task make Extensis Mask Pro 1.0 more appropriate for full-time rather than occasional computer artists. A completely smooth composite image (for which you paste a foreground image into a new background) requires hours of painstaking

ON THE BUTTON: PhotoButton, a utility in PhotoTools, creates matrices of buttons. Slider bars (left) let you adjust button shape and bevel.

labor to isolate the foreground object, smooth jaggy edges, and remove stray pixels. Professionals



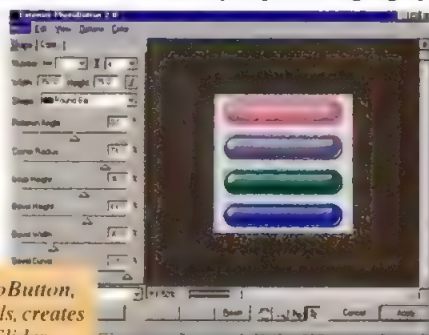
CREATIVE WRITING: Vertigo HotText places 3-D letters along an editable path. You can manipulate text using precise numeric inputs or interactive tools.

will appreciate the value of Mask Pro, which

provides precision tools to generate complex clipping paths or masks.

Mask Pro completely replaces the host program's interface with its own collection of tools and floating palettes. The basic method behind Mask Pro is simple: You use special eyedroppers to select colors to keep or remove.

Unlike conventional edge-detection tools, however, Mask Pro can negotiate intermediate colors that exist along the edge of the foreground/background relationship. The program does this based on the transition and threshold values that you set for the Magic Brush (or the Magic Wand), with which you delete the background. Mastering the interaction of the transition and threshold values isn't simple, but it's the key to producing highly



detailed, anti-aliased masks.

Mask Pro provides lots of other tools to fine-tune a mask, including a pen tool for drawing vector paths, normal painting

tools for adding or subtracting from a mask manually, and special views of the mask that make spotting and repairing holes easier. Our complaint is that the program previews only the current layer and not a multilayer composition, making it difficult to see exactly how the edges will blend with the new background.

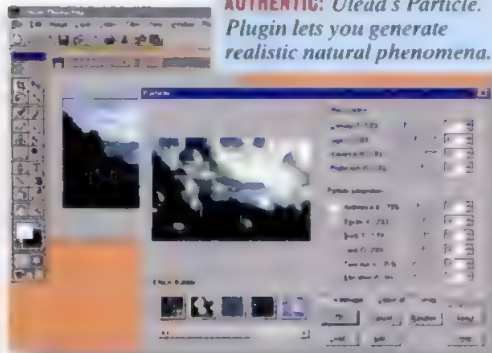
Our testing confirmed that Mask Pro can distinguish even between closely hued colors and can preserve fine detail, letting you create a seamless photo montage.

Extensis Mask Pro 1.0. Street price: \$300. Requires: Adobe Photoshop 3.0.5 or later or a host program that supports the Photoshop Plug-in 3.0 API, 32MB RAM, 4MB hard disk space, Microsoft Windows 95 or NT 4.0 or later. Extensis Corp., Portland, OR; 800-796-8798, 503-274-2020; www.extensis.com. Choose 408 at www.pcmag.com/infolink.

ULEAD PARTICLE.PLUGIN, TYPE.PLUGIN, AND SMARTSAVER

If you prefer to mix and match your own plug-in collection, you'll appreciate Ulead Systems' approach. The three plug-ins we tested each

AUTHENTIC: Ulead's Particle.Plugin lets you generate realistic natural phenomena.



have a street price of \$40 or less.

Particle.Plugin lets you instantly add eight naturalistic effects to an image or selection area. Type.Plugin offers 14 filters to enhance Photoshop's type (or any shape) with special effects such as

IN THE DETAILS: Extensis Mask Pro creates highly detailed, soft-edge masks based on foreground/background color differences.

ice, embossing, glass, and neon.

You select an effect from a thumbnail gallery and modify it by adjusting parameters. For example, it's easy to understand how density, size, and variance values affect the distribution of particles in a scene. Each product includes impressive technology yet has a simple, easily accessible interface. Particle.Plugin lets you individually select a large particle (like a bubble or a cloud) and adjust its appearance or position on-screen or in the stacking order. Type.Plugin supports advanced rendering options, like a bump map for the lighting effect or the ability to import custom shapes for the hole effect.

On a more practical level, Ulead is shipping a new version of SmartSaver, a program that optimizes and exports images in Web-appropriate formats. In

Ulead SmartSaver 3.0, one integrated interface gives you access to GIF, JPEG, and PNG formats. Switching among the different formats helps you see (in the pannable and zoomable preview area) which format best preserves image quality.

SmartSaver offers standard file-size-reduction options, including palette creation for GIF and PNG and compression-level options for JPEG. The new advanced options include the ability to create transparent areas by

importing a mask, generate transparent JPEG images, and import a background so that an image's dithered edges match your Web page's background.

We like the fact that SmartSaver reports the resulting file size, but we wish that it also gave average download times. Professionals will continue to use costlier and more powerful image-conversion products that can bias the color-reduction process and prefilter JPEG images for fewer artifacts. But business and home users will produce much more efficient Web graphics by using the intelligence built into SmartSaver.

Ulead Particle.Plugin. Street price: \$40. **Ulead SmartSaver 3.0.** Street price: \$40 (\$19.95 upgrade). **Ulead Type.Plugin.** Street price: \$30. Requires: 8MB RAM, 6MB hard disk space (8MB RAM for SmartSaver), Adobe Photoshop 32-bit plug-in compatible image editor, Microsoft Windows 95 or NT 4.0 or later. Ulead Systems, Torrance, CA; 800-858-5323, 310-523-9393; www.ulead.com. Choose 409 at www.pcmag.com/infolink.

VERTIGO HOTTEXT

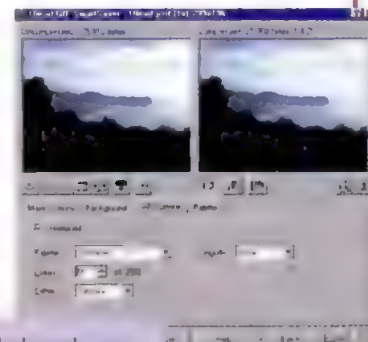
Vertigo HotText 1.0 (\$150 street) literally puts a different spin on text creation within an image-editing program: It can rotate extruded letters in 3-D space. HotText offers a 3-D feature set that includes the ability to convert TrueType and Type1 outlines into wireframe objects, customizable camera views, configurable ambient lights and spotlights, and surface colors and textures.

HotText borrows a paradigm from 2-D illustration programs, using standard Bezier tools to draw a path (or select and then

modify a preset path). Special tools let you slide, scale, and rotate your text along and around the 3-D path interactively or by using numeric inputs.

Tabs that divide functions into logical groupings make this program very easy to use. HotText uses QuickTime for Windows to provide interactive displays of solid shaded letters, but it relies on a special version of the LightWorks rendering engine to produce shadowed or transparent effects.

HotText has several hard-wired limits. For example, a scene can contain only 5 spotlights and 126 characters. Also, HotText is the only program in this roundup to work exclusive-



EITHER OR: Side-by-side preview in Ulead's SmartSaver lets you compare the quality of a compressed image with that of the original.

ly with Photoshop. In light of its price, we

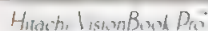
feel that the product should offer more power, including bump and reflection maps, the ability to import Photoshop paths, and an option to render the 3-D text to a new transparent layer. But those who want the convenience of true 3-D wireframes inside a 2-D raster program can find workarounds for these shortcomings.

Vertigo HotText 1.0. Street price: \$150. Requires: 8MB RAM, 5MB hard disk space, Adobe Photoshop 4.0 or later, QuickDraw for Windows 1.5.3 or later, Microsoft Windows 95 or NT 3.51 or later. Vertigo Technology Inc., Vancouver, BC, Canada; 604-684-2113, 888-483-7844; www.vertigo3d.com. Choose 410 at www.pcmag.com/infolink.





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1. *Handwritten text in German, mostly illegible due to blurring.*

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First Looks

PERIPHERALS

Easy to Recognize

The Parrott headset and SpeechMike bring convenience and comfort to voice recognition software users.

By Bruce Brown and Alfred Poor

If you've tried voice recognition and liked it, chances are you'll want to upgrade the headset that came with your software. VXI Corp.'s Parrott 10-QD headset (\$112 list) is comfortable to wear and designed specifically for accurate voice recognition. And if you spend a lot of time on the telephone, the Parrott 60V-10 (\$194 list) includes a switch that lets you use the same headset for telephony. Philips Speech Processing also takes advantage of voice recognition software with its SpeechMike (\$74.95 list), a high-tech update of the old dictation machine.

PARROTT

The Parrott headset has a monaural design with a pivoting microphone boom that you can use on either your left or right side. The company also makes the headsets bundled with Dragon products, but the rigid booms on those models aren't as easy to position as the Parrott's. The earpiece and headband on the Parrott are both more substantial than those on the bundled unit.

The Parrott's moderately flexible boom is a big step up from the too-flexible boom on the Andrea Electronics model bundled with IBM ViaVoice and ViaVoice Gold. In testing, the Andrea model tended to curl toward the wearer's face. There was no noticeable improvement in voice recognition accuracy in testing with the upgraded headset.

You can't plug the Parrott directly into audio card microphone and speaker jacks. The flat connector plugs into either

the Parrott 60V-10's switch box or the Parrott 10-QD's Quick Disconnect adapter cord, which lets you unplug the headset without having to reach behind your PC. The 60V-10's switch-box, which is both a switch and an amplifier, allows you to change the function of the head-



VOICE-OVER:
The Philips SpeechMike (left) updates the Dictaphone, and the Parrott headset takes dictation—and phone calls.

set with the push of a button. The switch has a volume-control dial for the earpiece and a less accessible, recessed gain control for the microphone.

Once you calibrate the volume and gain on the switch box, you can shift tasks easily. In a typical scenario, if the telephone should ring while you're dictating letters into your voice recognition program, you can simply press a button on the switch, lift the phone receiver, and converse using the headset.

The added comfort of the Parrott headset is its greatest appeal, but for frequent users, any extra comfort will make the experience more productive. The convenience of being able to use the same headset for telephony makes this product com-

bination a good investment.

Parrott 10-QD. List price: \$112.

Parrott 60V-10. List price: \$194.

Requires: Audio card or modem with microphone and headset/speaker jacks. VXI Corp., Rollinsford, NH; 800-742-8588, 603-742-2888; www.vxicorp.com. Choose 401 at www.pcmag.com/infolink.

PHILIPS SPEECHMIKE

Before personal computers came along, dictation machines were standard fixtures on executive desks. Now SpeechMike is offering to free

wires come from the same plug to connect to your sound card's microphone and speaker jacks. The device is compatible with the Logitech serial mouse and can happily coexist with a PS/2-style mouse or pointing device under Windows 95.

One limitation of the device is that the only installation instructions are printed on the back of the unit's box. The box fails to mention that the device works best with the Logitech serial mouse driver; in our evaluation, the device did not work with the standard Windows 95 serial mouse driver.

We tested the SpeechMike using some of the more popular speech recognition programs. The sound quality was acceptable for the programs, and although we had to experiment to learn how to position the unit and how loudly to speak, the proper arrangements soon became natural. The SpeechMike seemed to work just as well as a good-quality headset with boom mike—without putting your coiffure at risk.

Compared with the price of separate speakers, microphone, and trackball or mouse, the SpeechMike may seem a bit expensive. Also, the product doesn't come with any software at all, so you'll need to add your favorite speech recognition software or voice-recording package. If you want a single, sleek device to handle your computer-based dictation needs and will liberate you from your keyboard, the SpeechMike stands ready to take a letter.

Philips SpeechMike. List price: \$74.95. Requires: Microsoft Windows 95 or NT. Philips Speech Processing, Atlanta; 888-773-3244; www.speechmike.philips.com. Choose 402 at www.pcmag.com/infolink.



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The Computer Inside.™



First Looks

PERIPHERALS

Multifunction at Home

The HP Printer/Scanner/Copier Series 380 sets up easily and produces fine output, even with photos.

By Bruce Brown

Home PC users in the market for a new printer or scanner should consider the HP Printer/Scanner/Copier Series 380 (\$400 street). There's no fax with this device, but that isn't a big loss, since most fax jobs would be handled by fax modems found in most home PCs.

The HP ink jet engine (rated at 5 ppm and 600 dpi for black and at 2 ppm and 300 dpi for color) produces fine-quality print output. And using the integral optical 300-dpi (1,200-dpi interpolated) color scanner, it also does duty as a color copier. You can make black-and-white copies in standalone mode, but a PC must be connected and running to make color copies.

The dual-head ink jet design uses the standard black-ink and color cartridges simultaneously for four-color printing, resulting in greater economy and print quality. Replacement cartridges average around \$30, but for best results in printing photos, use the optional \$35 photo-ink cartridge.

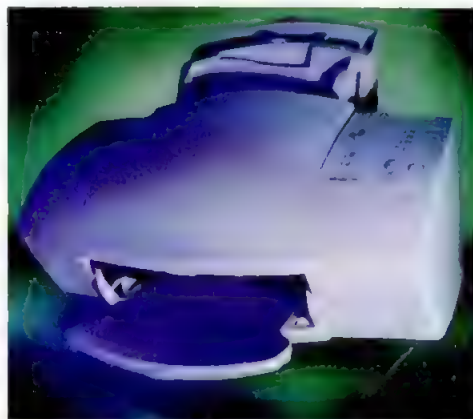
Setup, aided by hand-holding software, is quick and easy. Keep in mind that this printer (like other HP multifunction printers) can't share a printer port with other devices, such as removable storage devices.

The HP 380 works with a variety of papers, including photo paper, greeting card stock, labels, and T-shirt transfer paper, all available from HP. When you load the 20-sheet automatic document feeder, HP's document-assistant software pops up to walk you through scanning or copying. An included transparent plastic sleeve lets you scan small items, such as photos and business cards.

Bundled software includes the

photo-editing program Adobe PhotoDeluxe 2.0 and Caere OmniPage Limited Edition OCR. The HP software lets you crop, resize, and adjust the brightness of scanned images; for more advanced editing, you can set the software to scan photos into PhotoDeluxe automatically. The HP 380 also works with any Twain-compliant software for use with other scanning programs.

Printed output samples are certainly good enough for home, family, and school use. Although



the image fineness isn't as great as with the higher-resolution or the newer small-dot printers from HP and others, we found no noticeable artifacts or inconsistencies. Color copies were surprisingly true to the originals. Photographs, postcards, and photo-printer photo images

scanned and printed on HP Premium Photo paper looked almost as good as the originals.

Versatility, ease of use, powerful software, and surprisingly good printed output make the HP Printer/Scanner/Copier Series 380 an economical multipurpose home PC peripheral.

HP Printer/Scanner/Copier 380. Street price: \$400. Requires: 16MB RAM, 72MB hard disk space, unshared parallel printer port, Microsoft Windows 3.1, 95, or 98. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; fax, 800-333-1917; www.hp.com. Choose 411 at www.pcmag.com/infolink.

PERIPHERALS

Digital Developments

Transfer digital camera pictures to your PC using a floppy disk drive with the FlashPath adapter.

By Daniel Grotta and Sally Wiener Grotta

Downloading images from camera to computer is the most tedious part of digital photography. This usually involves attaching a serial cable, opening an image-editing program or Twain driver, making

sure the baud rate

adapter and a PC drive or reader.

The Olympus FlashPath floppy disk adapter (\$100 street) is an ingenious floppy disk-size device that lets you access 2MB, 4MB, or 8MB SmartMedia memory cards directly from a standard 3.5-inch floppy disk drive. Just slip the card into the adapter, insert it into a floppy disk drive, and the card will display, read, and write exactly like a standard floppy disk. It

also transfers image files faster than a serial port.

By contrast, a PC Card adapter like the Microtech Digital FlashFilm (\$89; 800-522-7835) is faster, slightly less expensive, but also less convenient.

You can't format SmartMedia cards in the FlashPath under Windows. For that you need to run the FlashPath's format utility. You should also avoid using SmartMedia's paper-dot write protect. The FlashPath ignores it anyway, and it could become un-

stuck inside the adapter.

If speed is more important than convenience and compatibility, the PC Card adapter wins hands down. Using the FlashPath, it took just over 163 seconds to transfer three TIF files totaling 3.8MB. With the same SmartMedia card and the FlashFilm adapter, the same transfer took only 3.8 seconds. The difference is that the PC Card drive transfers data at hard disk speeds, and the FlashPath adapter transfers at floppy disk speeds. But the FlashFilm requires a PC Card slot (almost all notebook PCs have PC Card slots, but relatively few desktops do), and you must power-down the device before removing the media.

FlashCard is Olympus's name for an licensed product marketed by Fisher, Fuji, and Toshiba. The card is free through June to buyers of the Olympus D320L digital camera. Once you try the FlashPath, you'll never again use a serial cable to get your digital images into the computer.

Olympus FlashPath. Street price: \$100. Olympus America, Melville, NY; 800-622-6372; www.olympus.com. Choose 403 at www.pcmag.com/infolink.



EASY GOING:

FlashPath is as easy to use as a floppy disk.

and COM ports are set correctly, and then waiting as each image transfers. It's easier and faster to transfer files directly from CompactFlash and SmartMedia cards, but that requires both a PC Card

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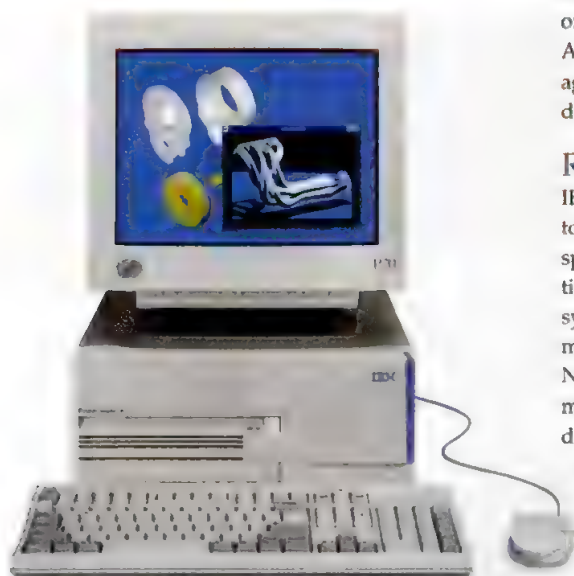


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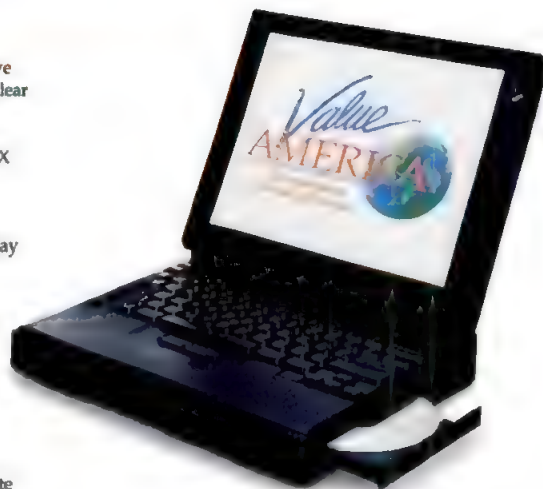
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First Looks

BIBLIOGRAPHIC SOFTWARE

Tracking References

EndNote and ProCite ease the job of creating accurate and consistent scholarly references.

By Barry Simon

Juggling scholarly references requires a specialized database. You need this database to be able to deal with a variety of record types, since books and articles require different fields. As different journals tend to require distinct citation formatting, you'll want to have specialized formatting tools, too. And finally, you'll want tools for importing from large commercial databases of references. Niles Software's EndNote 3.0 (\$299 list) and Research Information Systems' ProCite 4.0 (\$395.95 list) can handle all these duties and more. EndNote's top new feature lets you directly download citations over the Internet; ProCite's top draws are OLE and interface improvements.

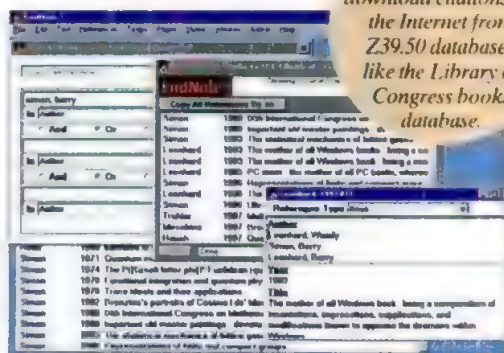
COMMON FEATURES

Both products have a basic set of capabilities. They support huge databases of references with different structures for books, articles, and a variety of other formats (EndNote has 17 record types, and ProCite has 28). They make good use of the Windows interface; both, for example, let you open multiple databases in separate windows and drag and drop records from one database to another.

The ability to keep track of styles seamlessly will make these products attractive to those who deal with the specialized formatting requirements of different scholarly journals. EndNote and ProCite have built-in links to Microsoft Word and Corel WordPerfect, but neither supports the TeX file type, which many scientists and engineers use to prepare technical manuscripts.

Menu items in both programs let you insert references from their databases as specialized Word fields. The programs will then provide macros that automatically generate reference lists, which you can format according to dozens of built-in styles for all the major journals. To shift from a reference list ordered alphabetically by authors' names to one sorted by order of appearance, you simply rerun a macro and make a different choice from a list of available styles.

Both programs keep pick lists of previous entries for fields you are likely to reuse, like "journal name." ProCite tracks these lists automatically, but EndNote forces you to go through a menu item to update them explicitly.



CLOSE AT HAND: EndNote lets you download citations via the Internet from Z39.50 databases, like the Library of Congress books database.

INTERNET CONNECTIVITY

The bibliographic community has its own Internet communication specification: It uses a spec known as Z39.50, rather than the familiar Web-based HTTP or FTP. The best-known bibliographic database of this type is the commercial service OVID; others include the Uni-

versity of California's MELVYN and the Library of Congress books database.

An item in EndNote's File menu lets you go out over the In-

ternet and connect to a variety of Z39.50 sources. (Some databases, like all of OVID and parts of MELVYN, require you to have an account; others, like parts of MELVYN and the Library of Congress database, are free.) Besides the Z39.50 connections, EndNote has a special link to Medline, the free Web-based database at the National Library of Medicine. On our tests, this connection was much slower than Medline's

Z39.50 commercial versions.

Some of these online databases include URLs for full-text versions of articles. EndNote maintains a URL field in its database and lets you launch your browser to that URL. With this power, EndNote leaps from being a tool for

merely tracking references to being a tool for library research.

ProCite doesn't offer a built-in Z39.50 connection, although BookWhere, from Sea Change Corp. (800-661-7274; www.seawest.seachange.com), lets you download and then import Z39.50 databases to ProCite. But the process is more compli-

cated than the transparent procedure available with EndNote. Note that for importing from CD-ROM and dial-in databases, EndNote and ProCite have integrated previously separate products (EndLink and BiblioLink, respectively).

INTERFACE CONSIDERATIONS

Although EndNote's online capabilities surpass ProCite's, the latter program has a better interface. In order to re-sort with EndNote, you have to go through a menu rather than simply click on a column head (the Windows 95 standard), as you can in ProCite. ProCite provides a preview pane in which you can choose a record by highlighting its entry in your database's table view, but EndNote makes you separately open each record you want to view in detail.

ProCite's Word Addin includes a handy built-in toolbar. Also, ProCite lets fields accept OLE objects—useful if, for example, you are making a database of papers that diagram chemical structures.

The choice here is between ProCite's somewhat smoother interface and EndNote's Z39.50 magic. Those who juggle bibliographic references will benefit enormously from either product.

EndNote 3.0. List price: \$299. Requires: 8MB RAM, 4MB hard disk space, Microsoft Windows 3.1, 95, or NT. Niles Software, Berkeley, CA; 800-554-3049, 510-559-8592; www.niles.com. Choose 406 at www.pcmag.com/infolink.

ProCite 4.0. List price: \$395. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 95 or NT. Research Information Systems, Carlsbad, CA; 800-722-1227, 760-438-5526; www.risinc.com. Choose 407 at www.pcmag.com/infolink.



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First Looks

PC NAVIGATION

Watch Where You're Going

Upgraded GPS navigation bundles from Datus and Etak make road trips safer and more efficient.

By Bruce Brown

As in-car navigation products continue to improve how they get drivers to their destinations, vendors are integrating features to get them there safely as well. Two new options, Etak's upgraded SkyMap Pro and Datus's RouteFinder GPS for Windows 95 2.0, improve GPS features while letting the driver watch the road and not a computer screen. (For a review of the new Magellan GPS, visit www.firstlooks.com.)

SKYMAP PRO

SkyMap Pro (\$299.95 list) ships with a 12-channel PC Card GPS reader and an infrared remote control. The hardware remains unchanged, but the software's numerous enhancements include features for navigation, data, and ease of use.

SkyMap Pro's interface changes include high-visibility map, compass, and

feature to display where you've been or activate the trip recorder.

Etak's bundled contact manager automatically geocodes (assigns x- and y-coordinates to) locations; it assigns map icons to contact locations and landmarks. Also, with a modem connection, you can use the address book to dial the phone or send faxes.

When used in a car with the GPS, SkyMap Pro's 12-channel unit quickly acquires the location signal. The PC connects to and powers the receiver via a Type II PC Card. The infrared remote has zoom and menu buttons, a control for information on points of interest, and a joysticklike direction button that lets you scroll through the current map.

Although you can't speak to

tion and the current heading.

With its voice alerts, contact-management function, routing, location information, and highly visible screens, SkyMap Pro is a powerful tool for travelers.

SkyMap Pro. List price: \$299.95. Requires: 16MB RAM, 25MB hard disk space, PC Card slot, Microsoft Windows 95. Etak Inc., Menlo Park, CA: 888-275-9627, 650-328-3825;

the program while you're driving from a metropolitan area into an area with less detail can be disconcerting. If you use the GPS in an area with no local street information, the on-screen vehicle-location indicator appears off the road on the map. When you get back onto the recognized road network, the program can once again keep you on track.

Just like SkyMap, RouteFinder (with RouteFinder GPS) uses voice alerts to inform you of upcoming turns, but it doesn't tell you if you made a wrong one. Unlike SkyMap, RouteFinder doesn't inform you of changes in speed and heading.

We observed a few glitches in testing. You can run RouteFinder directly from the CD-ROM drive, but the installation instructions are unclear. When viewing point-of-interest information (which works only within one city at a time), you can change the radius from the current location to find hospitals, restaurants, hotels, banks, gas stations, and airports. But in our tests, the information didn't always update when we changed the radius. Datus is correcting both problems.

A high degree of road detail in the covered areas makes RouteFinder for Windows 95 2.0 desirable in metropolitan areas, but it's not as useful in less populated areas.

RouteFinder for Windows 95 2.0. List price: \$69. RouteFinder GPS for Windows 95, \$138.95 (list); GPS receiver, \$169.95 (direct); additional area databases, \$39 each (direct). Requires: 8MB RAM, 300MB to 400MB hard disk space (none if run from CD-ROM), CD-ROM drive, Microsoft Windows 95. Datus Inc., San Jose, CA: 888-462-8627, 408-360-4200; www.routefinderpna.com. Choose 405 at www.pcmag.com/infolink.



WHICH WAY? RouteFinder splits the screen with turn directions and a street map.

www.etak.com/startGPS. Choose 404 at www.pcmag.com/infolink.

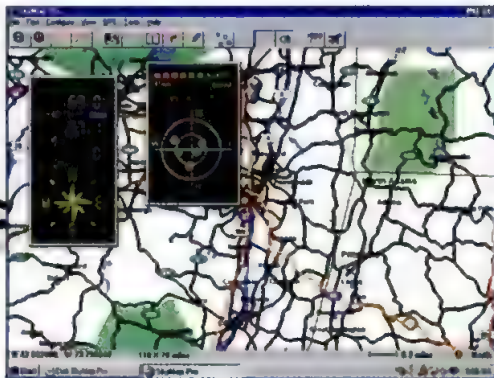
ROUTEFINDER GPS

The major appeal of RouteFinder's data is the amount of information for large metropolitan areas—up to 150

attributes per road segment, including such data as one-way streets, turn restrictions, and speed ranges. RouteFinder for Windows 95 2.0 (\$69 list) includes one regional database disk; additional disks cost \$39 each. For in-car use, you'll need the

RouteFinder GPS for Windows 95 software (\$138.95 list) and a 12-channel GPS (\$169.95 direct). The program also works with any NMEA-standard GPS with a PC connection.

The directions and point-of-interest information in the NavTech databases are generally highly accurate, although using



I SEE: SkyMap Pro's map, compass, and GPS status screens are optimized for visibility while driving.



GPS status screens for easier laptop viewing. Another feature gives you an overview map in one window and a zoomed-in map in another.

You can use SkyMap Pro to find specific addresses or points of interest. You can plan your route (including waypoints) starting from your current location (with the GPS) or another place you specify. While traveling, you can turn on a "bread-crumbs"

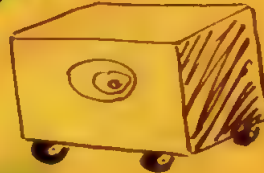
SkyMap Pro to inquire about directions or your location, you can set customizable voice alerts to inform you of speed, direction, next-turn data, and GPS status—making looking at the screen unnecessary. If you make an incorrect turn, SkyMap Pro doesn't tell you, but it does announce the destination direc-

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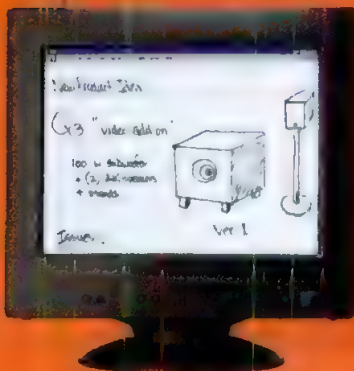
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Second Looks

POWERDESK UTILITIES 98

Refine Your Desktop

By Barry Simon

Although each version of Windows has improved the interface for program launching and file management, a number of refinements are still missing, particularly for the user who wants more control. Mijenix Corp. (800-645-3649, 303-245-8000; www.mijenix.com) fills in the gaps with its versatile PowerDesk Utilities 98 (\$30 street), a utility that improves virtually all aspects of system interaction. This version adds a number of enhancements to the release we last reviewed ("Miscellaneous Utilities," April 8, 1997), and it marks the first time that the product has been available at retail.

At the heart of PowerDesk Utilities is the replacement file manager, PowerDesk, which is essentially the Windows 95 Ex-

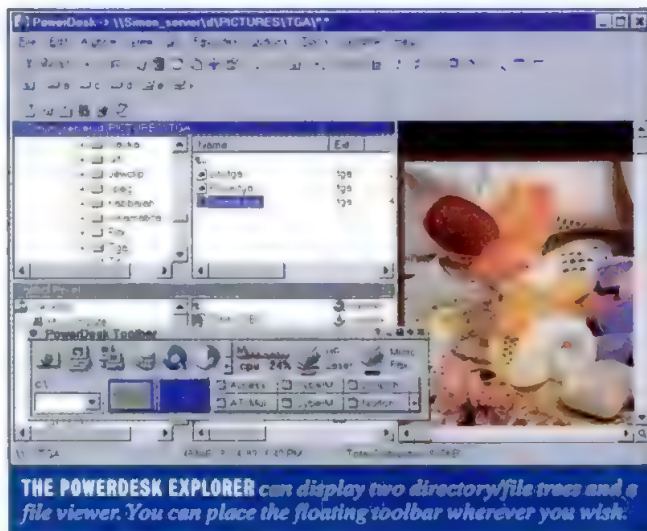
plorer on steroids. PowerDesk offers two views. The first is modeled after the standard Explorer interface; the second harkens back to the Windows 3.1 File Manager, with its horizontal arrangement, which allows for easy drag-and-drop file management between file-tree windows.

New to this version is the ability to open a file-viewer pane from within the file manager. The viewer uses part of Inso Corp.'s engine and supports over 80 file formats. Also, you can now convert between any of 24 popular graphics formats. Another convenience: the inclusion of a separate application called Size Manager, which lets you observe which folders are taking up the most space on your hard disk.

As you would expect from the

maker of ZipMagic, PowerDesk Utilities includes strong support for compressed files (including ARC, ARJ, CAB, GZ, LHA, TAR, Z, and ZIP files). Not only

now automatically extends a large ZIP file across multiple disks, and it offers seamless support for BinHex, uuencode, and uudecode files.



can the program display compressed files as folders, but individual files within a compressed file are accessible via drag-and-drop. Also, PowerDesk Utilities

One of our favorite new features is the Dialog Helper. By adding two buttons to the standard File/Open and File/Save/Save As dialogs in Windows applications, this feature lets you track folders and files that you've recently used in an application.

Another standout feature is PowerDesk Utilities' multifaceted, fully configurable toolbar, which can either float on your desktop or reside on your system tray. You can include such elements such as quick-launch buttons for applications and Web sites, a printer selector, a DOS command line, and a system manager.

PowerDesk Utilities 98 offers something for everyone, both beginners and power users. With its standalone file manager, floating toolbar, Explorer extensions, and dialog helper, the program is a cornucopia of delights.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Carol Venezia at cvenezia@zd.com.

UTILITIES

Popular Utility Fixes

By Brett Krasnowe

Several utilities we reviewed in our 1998 Utility Guide (*PC Magazine*, March 24) now have point updates.

Symantec Corp. has upped Norton Utilities 3.0 to Version 3.05; you can download a LiveUpdate patch by selecting the LiveUpdate option within NU first, or by going directly to Symantec's FTP site (via www.symantec.com/nu/nu3fix.html). This point release includes several corrective measures. For example, many users of Version 3.0 encountered a problem when using the Norton Optimization Wizard; Symantec discovered that this was due to physical corruption in the users' system registries.

Symantec has posted Optwiz.exe, which adds a feature called Corrupt Registry Repair. Each user can now optimize the registry.

Symantec has fixed another problem: Norton Speed Disk continually restarted on large FAT32 partitions. It has also corrected a malfunction that kept the Norton Protected Recycle Bin shield icon from properly reflecting the state of the Recycle Bin. And Norton SpeedStart—which caused crashes in various applications at start-up—now disposes of old profiles after 30 days, preventing an overload of stored profiles. Also in the update is a new NortonCrashGuard directory, which prevents systems from hanging on start-up.

American Megatrends (www.ami.com) is phasing out another troubleshooting utility we reviewed in our March 24 Utility Guide, PC Care 97. AMI plans to replace it with AMI_ClientCare, a family of products designed to reduce total cost of ownership through health monitoring, system configuration utilities, hardware diagnostics, and remote capability.

Users of Quarterdeck's CleanSweep Deluxe, our Editors' Choice winner among uninstallers in our Utility Guide, can upgrade from Version 3.08 to 4.0 free via www.quarterdeck.com. By launching Update-It under Options, you can automatically download the two new components, Fast & Safe Cleanup and The Quarterdeck Safe. CleanSweep 3.06 and 3.07 users need to upgrade to Version 3.08 before moving to Version 4.0.

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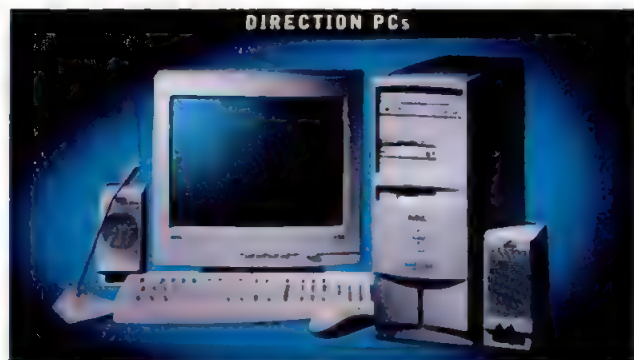


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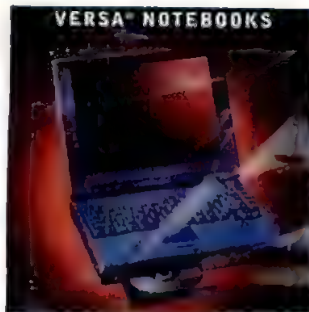
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*Windows Magazine,
Feb. 1998*

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Dot Pitch	.27	.25
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Recommended Resolution	1,024 x 768 @ 87Hz	1,600 x 1,200 @ 76Hz

Technology Sells

We were going to be rich. It was the killer idea, the one that would catapult my two partners and me into the rarefied cadre of computer innovators and wealthy entrepreneurs. It was 1980. The IBM PC was still a well-kept secret. Our idea? Computerize

the sales force: that last great bastion of manual work, shabby record-keeping, and haphazard business intelligence. Our software ran on microcomputers, powerful Z-80 machines with 64K, running at a blistering 4 MHz. The data files fit on 1.2MB 8-inch floppy disks, but for really big installations we could provide a monster 10MB Fujitsu hard disk. Our standard output device was the ground-pounding NEC Spinwriter, pumping out 30 characters per second—bidirectionally.

I was the software guy, and I built the hardware in my spare time. One partner was the sales guy and the other the financial guy. Rich, I tell you, rich!

We lost our shirts.

We actually sold some systems, and they actually worked, but the salespeople hated them because they received little or no benefit. It was a sales management system, after all, and what salesperson wants to be put under a microscope, then have to process forms and write up every little move?

Remember that in 1980, the vast majority of the adult male population didn't know how to type or had conveniently forgotten after the last college term paper. The laptop PC had yet to be invented. The fastest modem you could buy was 1,200 bps, and it cost \$700. Yes, in theory, good market intelligence and orderly follow-up mean increased sales, but the technology of the time put so much separation between actions and results that results were undetectable to heat-seeking salespeople.

Today, computers are indispensable. Knowledge is power, and even the greenest sales trainee knows it.

After 18 years, sales-force automation has come a long way. It's a recognized software category, and there's even a magazine devoted to the subject. Sales automation is actually quite broad, covering contact management, account management, market intelligence, geographic and demographic analysis, territory alignment, remote order entry, online inventory management, lead generation and tracking, training, presentation, customer support, and more.

But it's still a sorry business. You'll get more than 8,000 hits if you enter *sales force automation* into a search en-

gine, but you'll get back a lot of broken links and amateur-hour sites. The get-rich dreams are still with us, and nobody dreams bigger than a salesperson, but much of the software is sadly lacking.

There's good stuff out there. But you'll have to do some real digging and make a significant investment of your time to find the best package.

After having sold the popular Act! contact management package to Symantec, Pat Sullivan is back with a comprehensive sales information system (www.saleslogix.com). This system goes far beyond contact management. Its greatest strengths are accessing, creating, and maintaining corporate databases of sales information, from the home office or the field.

DownEast Technology's SalesBook (www.salesbook.com) uses a tabbed interface to get as much useful information in front of you as possible. Although the program makes some fuss about its Sales Activity Map, this is little more than a flowchart of sales steps that most reps can do in their sleep. It's a highly modular system that you can mix and match with off-the-shelf apps and custom software.

Some new products are designed specifically for the Web. Firstwave's Netgain Takecontrol (www.firstwave.net) is such a product, and it's particularly strong in collaborative, team-oriented environments.

UpShot (www.upshot.com/products/factsNmore) is the most Web-centric product I've seen. Its applications run in-

side a browser. A neat feature alerts you to relevant changes at the Web sites of customers, leads, and competitors. Paradoxically, the company's Web site is pretty but slow.

Some of the more traditional sales management companies, such as Aurum (www.aurum.com), have modules that turn visitors to your Web site into leads. Capturing Web-visit information isn't rocket science, but the integration with existing sales management modules is handy.

These are just a few of the hundreds of viable possibilities in sales automation. But they're representative of some of the technology that has crystallized around a traditionally unruly, unmanageable discipline. **PC**



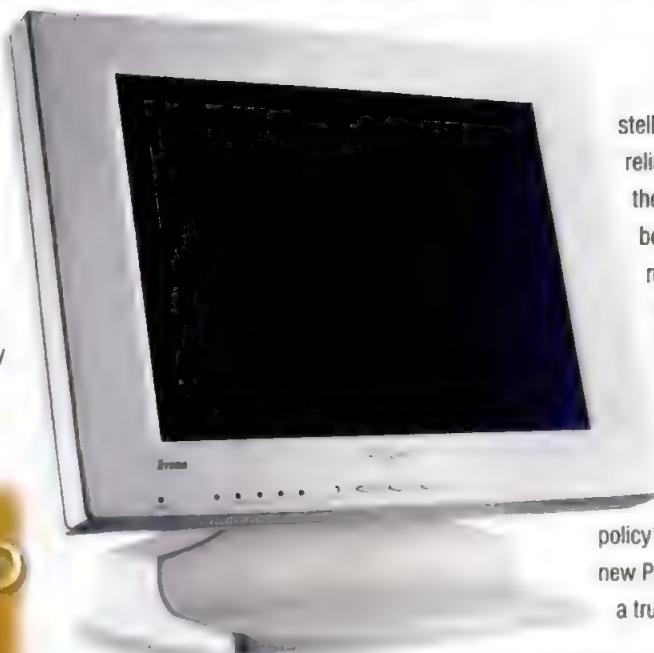
SALES SOFTWARE

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Maximum Resolution	1024 x 768
Dot Clock	79MHz maximum
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The End Is Near

Over the years, I've seen pauses in the growth of the computer industry, followed by pronouncements that the market is saturated. The experts then claim the market is a "replacement" business. Then they say it's all over. I'm expecting this scenario to

reemerge in the months ahead, and this time the experts may possibly be right.

A few years ago, when the market surged, the theory disappeared. I find this curious because, from what I can see, we're at a saturation point now, with resistance everywhere. I don't see newcomers entering the market, and why should they? Maybe in China, but not in the United States. I mean, the PC revolution began almost 25 years ago, and if you haven't found any reason to own a computer by now, then why would this change over the next year? Maybe for the Internet?

Enter WebTV: The second iteration actually kills that argument. Combine WebTV with the slew of set-top boxes we'll see when Windows 98 is unveiled and you have the end of the road for the desktop PC. I recently reviewed some WebTV systems, and the second generation are quite impressive, especially in their ability to self-configure and go to work with no user intervention. Combine that easy setup with excellent navigation tools and you end up with a Web-browsing experience that is far better than you'd expect. Phenomenal, in fact.

There is no question that WebTV will pick up the slack in many households that don't want or need computers, and sales may boom. This means more money for Microsoft. Or does it? This product has no real software constituent, no word processors, no never-ending upgrades. In fact, WebTV's a dead end for Microsoft.

The system is so impressive that I must assume Microsoft would just as soon kill it as promote it. After all, WebTV kills Microsoft's lucrative market for software upgrades.

So where will growth come from? It won't be from overly complex programs such as Microsoft Outlook 98—a Herculean effort that nobody wants. Using this product is simply too much of a chore; It's just an elaborate address book. This isn't where future growth is going to come from. In fact, there is no future growth unless Microsoft can come up with something new, and nothing seems to be out there.

Here are the killer apps and their statuses. (1) Word processing. Status: Moribund; there's nothing new to be done. (2)

Database management. Status: Same as above. (3) Spreadsheets. Status: Moribund; now unexciting. (4) Telecommunications. Status: Dead; killed by the Web, TCP/IP, and browsers. In this category, the traditional "telecom" program hardly exists anymore. (5) Games. Status: Alive and well, with

new formats. Curiously, this is a category not dominated by Microsoft. (6) Graphics. Status: Flat. (7) Photo editing. Status: Still shaking down; relatively new category. (8) Web browsers. Status: Flat; Microsoft dominates. (9) Utilities. Status: Flat. (10) Antivirus software. Status: Moribund.

I suppose there are a couple more killer apps, but the story is the same: Nothing exciting is happening. Does anyone notice that Microsoft's dominance is not helping the situation? Many semi-interesting categories have totally disappeared. Outliners, for example, was a viable type of software until Microsoft incorporated it into Word. Presentation software has been decimated since PowerPoint has been bundled with Microsoft Office. Meanwhile, nothing is on the horizon. Add to this void the development of the true replacement market, as mentioned above, and the computing business is going to slow to a halt if a new use isn't found for it. I sure can't think of one.

I'm wondering to what real use I can put the 400-MHz machine I'm now toying with. Over the past few years, I've upgraded more often than I ever had before, turning over a machine every six months. Upgrading is agony, and I've received a lot of

letters from readers telling me it's more than they can bear, too. Moving programs from machine to machine is ridiculously difficult. This problem and backlash will exacerbate the industry slowdown. None of this is good news to me, since I write about computing for a living. I've always been able to make the argument that people should keep buying new machines. But this is getting more difficult all the time. The sudden emergence of cheap machines and PalmPilot mania confirms the worsening situation.

I suspect that the emphasis on the biggest and fastest will eventually give way to concerns about value, practicality, new features, and even aesthetics.



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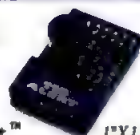


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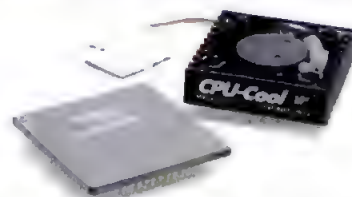
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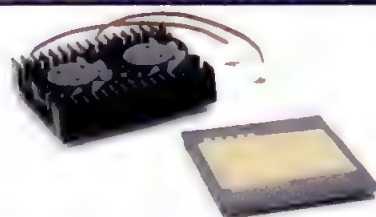
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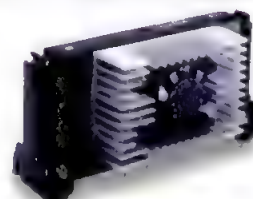


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JOHN C. DVORAK

Inside Track

Funny how various ideas that enter the market and fail keep returning to fail again and again. It's like **the syndrome that killed comedy**: tell the same joke over and over in hopes that it will eventually get a laugh. This seldom happens, because the joke is rarely funny in the first place. But over time things change, and what wasn't funny one moment might be **hilarious** under different circumstances. In the same vein, **Intel** has relit a fire under the idea that special-purpose CPUs are somehow a good idea.

The entire business that Intel is in is built around the idea that a general-purpose CPU—because of its versatility and programmability—can do any chore. When the first microprocessors arrived, it was only a matter of time before these devices **destroyed special-purpose chips** and dedicated systems. They would always be made in enough volume to be so cheap that nothing could compete with them. Dedicated word processors were the first obvious casualty. Now the chips are in everything, including supercomputers.

The idea that a special-purpose CPU would **save money** on parts and have special features has come up often over the years. There was a period in the 1980s when predictions arose that this kind of chip would **dominate**. It never did, despite the hype. Then the Cyrix MediaGX came along, which I think triggered the recent thinking at Intel. This chip incorporates special features needed to **make a cheap desktop computer**. The chip seems like a good idea and has triggered the sub-\$1,000-PC revolution. In fact, the MediaGX fell into a market segment that nobody believed existed. AMD has shown that a general-purpose CPU can fill that void, too. I was a strong supporter of the MediaGX concept until someone pointed out that there are numerous subsystems on the same chip, and they will have to **evolve at the same rate** as the components or the MediaGX will be left behind. No

So this type of chip, to be practical, becomes as opposed to an evolving line of chips.

That the industry will change to **market-t chips**. An elaborate multipurpose chip manufactured, and discontinued, to be something totally different. We may stop seeing **raw-speed progression** we've seen since the introduction of the 8080. Intel's recent Celeron and Xeon chips may be the beginning of a new direction for the company. Surely the slowdown in the business and the **lack of raw horsepower** (see my

a new direction in chip marketing

We may stop seeing the never-ending raw-speed progression we've watched since the introduction of the 8080. Intel's recent introduction of the Celeron and Xeon chips may be the beginning of a new direction for the company.

seems to be confirmed at National Semiconductor (Cyrix). In April the company announced that it was planning to put an **entire PC on a chip**, to be used in everything from sub-\$1,000 machines to automobile dashboards. The chip will be delivered in the middle of next year. Using a Cyrix core as the basis for the chip, National Semiconductor has **quietly bought a slew of other small companies** that will contribute to the design, including PicoPower (August 1996) for system logic, Mediamatics (March 1997) for MPEG video decompression, FIS (November 1997) for graphics, and Gulbransen (January 1998) for audio compression.

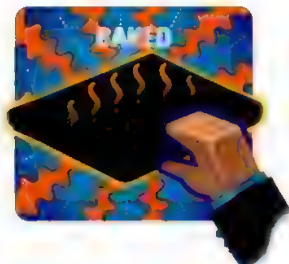
National Semiconductor itself is loaded with specialized expertise—including analog technologies not

found elsewhere—that will let it piece together an integrated product that may **stun the industry**. The company says it will roll out the first chips using 0.25-micron technology, then quickly jump to 0.18-micron technology. Of course, National Semiconductor is staying in the general-purpose CPU game with its recent announcement of the 300-MHz MII, which it says is **cheaper and faster** than a Celeron-based PC.

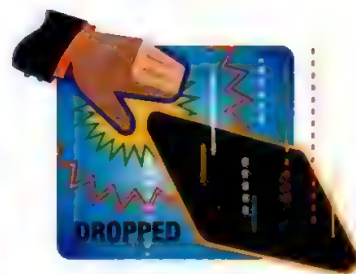
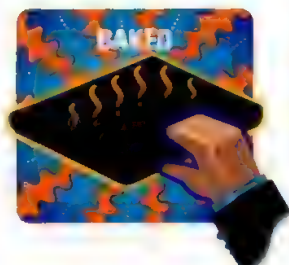
Intel is also positioned to do a computer on a chip. This must pain the company, though, since its traditional modus operandi is to be the **rabbit** in a greyhound race. Putting together a system on a chip might actually put Intel at a disadvantage.

I was actually **amused** by the Intel announcement of specialty chips. Paul Otellini, general manager of Intel's Architecture Business Group, rolled out the Intel scheme to make more "tailor-made" chips, in his address at Spring Comdex. But in the process of discussing this, he still emphasized **cranking up the processing power** for mainstream, general-purpose CPUs, and he made an interesting comment that was reported on ZDNet. Otellini criticized naysayers (I am in this bunch, at the moment) who have doubted that the pace of innovation can continue (in other words, we've stagnated, especially on the software side). His response: "I remember seeing that same article written for the 286, 386, 486, and Pentium II." I found this interesting, since I was writing about the same chips during the same era and **never** saw "the same article." What I did see was **constant assertions by Intel** that each new chip would be used for servers and never find its way onto the desktop, because it was too powerful. As far as I recall, Intel always promoted this concept. Most of the writers and observers who weren't simply parroting Intel propaganda wanted the chips on the desktop ASAP. So Otellini's assertions are nonsense. I suspect the company is **quite freaked** by the current market conditions. **PC**

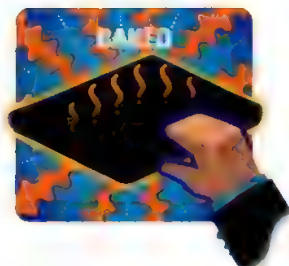
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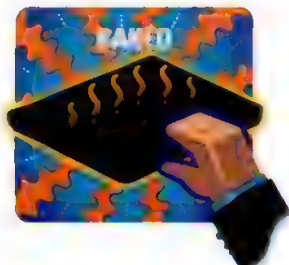
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Y2K v. 2: Time for Triage

Several issues back, I jumped up and down about the Y2K crisis barreling down on a largely blasé world. In that column I urged you to stick a pin in the right people at your company *now*, lest you come in to work on Monday morning, January 2, 2000, to

find some very unpleasant surprises.

I want to follow up with some suggestions about what you can do at this relatively late date to push your company, large or small, toward the right decisions and right actions to minimize Y2K disasters. I also want to pass along some of the information I've been gathering on how the Y2K problem will affect your own PC and software and what you can do about that. This time we'll look at survival strategies, circa mid-1998; look for the follow-up column "Y2K and Your PC," coming to this space soon.

I've watched reactions to the impending Y2K crunch go through five distinct phases. First there was classic, bury-your-head-in-the-sand denial: It ain't gonna happen.

Second, smart early-response companies developed and sometimes put into place comprehensive plans to test and fix everything having to do with Y2K date errors in their software and hardware well before the end of 1999.

Third, we moved into a period of shock and dismay as we discovered just how much of that old spaghetti code is still Out There and in daily use and how large and daunting the problems really are.

Fourth, we went through the "don't fix it, dump it" stage, when companies decided they had to abandon that legacy code and the creaking boxes that ran the code by moving on to modern hardware and software in client/server architectures. That was a smart and ultimately cost-effective strategy indeed, which did wonders for the likes of Baan, SAP, and others while there was still time to design, implement, and test those new systems.

Today we have moved into the fifth stage, which I can only call triage. Companies are recognizing that unless their Y2K-fix programs are already well underway and they're starting to get into testing their new code, they haven't a chance of fixing everything in time. So they're engaging in battlefield triage, deciding which of their vital systems they're going to let go *boom!* on January 1, 2000, and which absolutely, inescapably must—and still can—be fixed by then.

It's a bloody, ugly process. Telling a manager you've decided one or a dozen of the systems his troops rely on will probably go south in eighteen months, and you've decided you can't even try to fix the problem by then, leads to very tense sessions. I know; clients have been calling me to come sit at the table while they tell managers this unpleasant truth.

We do this in tiers, first briefing top management on the progress of the triage process and the specifics of what we believe can (and hope will) be saved, as well as what cannot be salvaged. This is both good management—remember, you manage up as well as down—and also, frankly, a survival technique: Every manager who's told that some of the systems his people need will go awry in eighteen months immediately goes to his boss, and then to his boss's boss, to get the decision overturned. When he or she finally hears that the CEO and board have signed off on the decision, it helps calm things down a little—superficially, at least.

If you're offended by my use of the grisly battlefield term *triage*, you have my apologies. But I know of no other word that accurately describes the nature and temper of these decisions. Often the meetings in which we try to make the decisions take days, with a large number of restarts. We'll spend a day trying to whittle down a list of 275 programs to an agreed-upon target of, say, 90; and at the end of that long and

wearying day, we'll find we've succumbed to so many special pleas to keep just this one, or just that one, that our list still includes 211 proposed survivors. It doesn't work that way, so the next morning (or continuing that night over bad take-out food and bitter coffee) we tackle the list again.

I describe this not to win your sympathy—I'm paid well for this work and do it by choice, so I deserve what I get—but to cast the die for the path ahead of you if you try to push your company toward a rational response to the Y2K challenges. You may become a hero in a couple of years, but you are not going to be seen as Mr. Nice Guy



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If you see some movement in your company, but not much, toward anticipating and solving the Y2K dilemma, you're not alone. A recent report by Triaxis Research captures the situation today very well: At the 250 largest public U.S. companies, which together have total projected Y2K-fix expenditures of \$30-billion plus, only 20 percent of that amount has been spent so far.

This is turning into the biggest endgame ever for U.S. businesses. Add in the cost and complexity of programming Eurodollar conversions—the EU has demanded a remarkably complex triangulation method for determining national currency-conversion rates—and we are in big trouble, indeed. Even the consultants and others who will make out like bandits in this next frenzied year and a half to two years take little delight in the last-minute nature of so much of the work. It will be bloody and expensive, and we still won't get all the work done in time. Probably not even most of it.

If you are working on Y2K answers for your company or trying to get the company moving on this, seriously consider the triage approach. In almost every case, you'll find that as good a time as this may be simply to abandon the old stuff and move to the new—a decision that is probably right for the key "survivor" processes you identify—you simply won't be able to replace everything in time. Deciding what to let go, while protecting things like payroll and accounts receivable and payable—and all those other well-hidden programs that are the information nervous system of your company—is a tough road, but it's the only approach that will let you focus sufficient resources on the essential, salvageable survivors.

And there are very few competent, experienced people available to help you fix the old systems. I've seen elderly COBOL programmers, who retired in the 1970s after making \$32,000 at their peak, brought back in 1997 as \$85,000-a-year contract employees. And last month a client hired a 27-year-old who was heading one of several Y2K teams at a competitor to run that client's Y2K teams—for a five-year, no-cut contract at \$200,000 a year, plus a \$50,000 signing bonus. He was a nifty guy and asked for the million bucks on a take-it-or-leave-it basis. And he got what he wanted.

Makes signing the POs for the new stuff a little easier, doesn't it? **PC**

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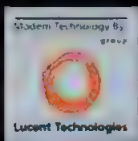
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Is It Time to Buy a New PC?

June may not be peak buying season for home or small-business PCs. But buying is certainly an interesting proposition this year, given the greater variety of processor choices, new buses, an upgraded operating system, and, of course, those ever-lower prices.

The big processor news is at both ends of the spectrum: 350-MHz and 400-MHz Pentium II processors for power users and the 266-MHz Celeron for value-conscious buyers.

Celeron represents Intel's warning shot across the bow of AMD and Cyrix. Intel is serious about playing in the \$1,000 market, albeit not currently at the very lowest end of the market. Whether you should help Intel send the message by buying in is another matter. Celeron, as most of us know, is the cacheless Pentium II chip. Think of Celeron as another in the long line of Intel SX products, SX being the CPU with something missing. This time, what's missing is the Pentium II's level-2 cache.

When it comes to performance, truth in labeling would be better served, as my colleague Bill Machrone notes, were the chip named Deceleron. Many users will see about the same level of performance with Celeron as they get with previous-generation Pentium MMX CPUs. Celeron will be a lot more interesting in about six months, when it's widely believed that Intel will come out with a version of the chip that has 128K of L2 cache. This one's code-named Mendocino, although it will likely fall under the Celeron name. Celeron will be Intel's name for its entry-level CPUs, and Xeon will be the name for the very highest-level processors, including those for workstations and servers.

If I were buying a personal or home PC now, here's what I'd be looking for.

First, the initial cacheless iteration of Celeron would not be on my list. An AMD K6, a Cyrix 6x86, a Pentium MMX, and a low-end Pentium II would all make more logical choices, if I were cost-conscious.

Second, since we're this close—barring something rash from the Justice Department, like an injunction—I'd wait a few weeks for PCs with Microsoft Windows 98 pre-installed. No sense getting Win 95 and a free-upgrade coupon. There are enough nice features in Win 98 to make it more desirable than Win 95.

Third, I'd be very careful about the monitor I got with my PC. Earlier this year in PC Labs, we saw a lot of low-end PC-

and-monitor bundles in which the monitors were, politely put, suboptimal. Look for a higher-end 15-inch monitor or, even better, a 17-inch monitor. Occasionally, there's an advantage to taking the monitor offered by the vendor you're buying your system from, but you'll get more variety and in

some cases better quality by looking to third parties. Give some thought to LCD monitors. There are 15-inch 1,024-by-768 panels for \$1,000 now. They're not cheap, but they're pretty impressive if you're in a small apartment or cramped home office.

All the PCs you buy now will have universal serial bus (USB) ports that actually work. That should cure some of your interrupt hassles, because you can attach external devices that don't use interrupts. A PC with USB ports will also give you an instant network with the addition of a \$75 external USB network adapter. A few systems will ship with IEEE 1394 (FireWire) ports as well, and this is an important link to the future. FireWire will be the way you connect consumer audio/video devices and external drives. If you're in the market for a high-end Hi-8 camera, which can run \$1,000 plus, think instead about the DV camcorders that have FireWire ports and are heading down toward \$1,500.

The best combination of price and performance right now is probably a Pentium II, in the 300- to 350-MHz range, for about \$1,500. The 350- and 400-MHz CPUs with the BX chip sets support 100-MHz system buses, which really helps overall performance.

The faster bus demands higher-quality RAM, so either specify all you need at purchase time or choose your aftermarket supplier carefully. Get 64MB and think about 128MB—seriously—for an extra \$200 to \$250. Drives are so cheap that there's no reason not to get 10MB.

For a fully loaded system, you'll pay \$2,500 to \$3,000 with a 17-inch monitor. A lesser system that would have been breathtakingly fast 12 months ago will cost \$1,500. I'm still suspicious about the long-term benefit of buying \$1,000 PCs, with two exceptions: If you know you're doing only word processing or surfing the Internet, then a subzero PC is good enough. **PC**



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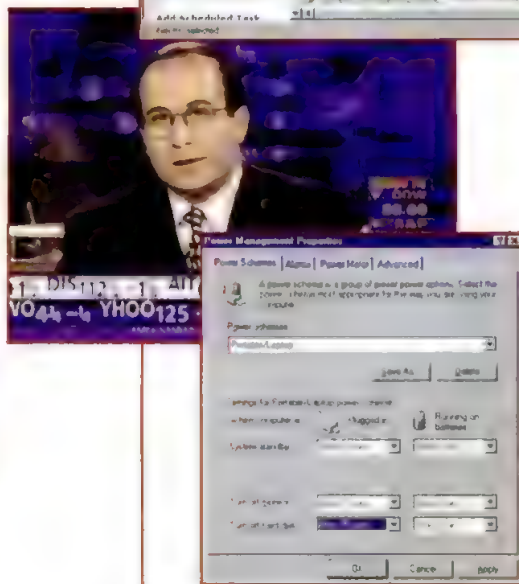
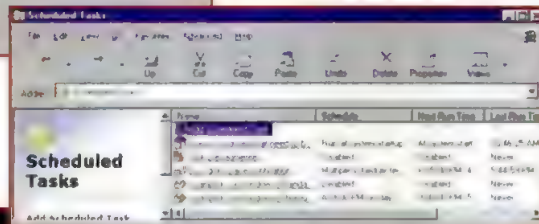
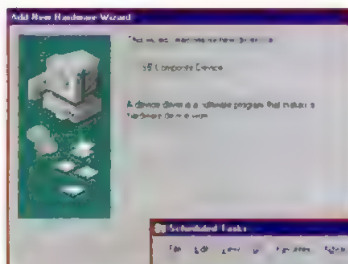
What You Need to Know WIND



NEW INTERFACE

Windows 98 adds many Web-integration features, such as the Channel Bar, to your desktop. Most of them can be turned off so that your system looks just like Windows 95.

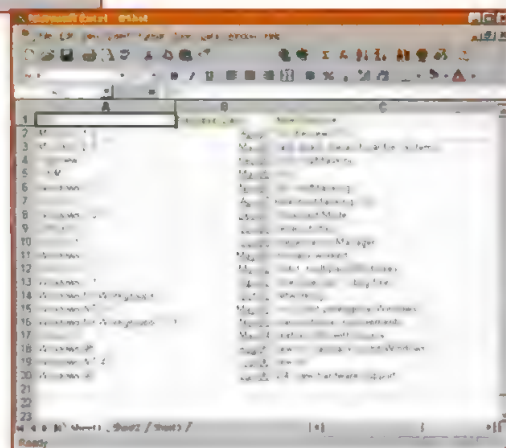
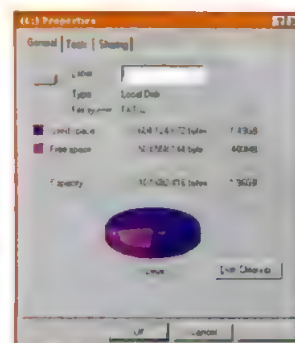
page 162



COOLER MULTIMEDIA

As the PC and TV begin to converge, Windows 98 gives this development a push with its integrated Broadcast Architecture, which lets you watch TV on your PC and includes a number of other video enhancements.

page 122



LAPTOP-RELATED ENHANCEMENTS

New power management schemes show that Windows 98 seeks to address one of the greatest needs of road warriors: better battery-life performance.

page 116

DEVELOPER TOOLS

With the Windows Scripting Host to script PC functions much as you would a Web page, and with the Windows Driver Model to let developers write Windows 98 and Windows NT device drivers at the same time, developers should stay plenty busy.

page 125

About

OWS

BETTER HARDWARE SUPPORT

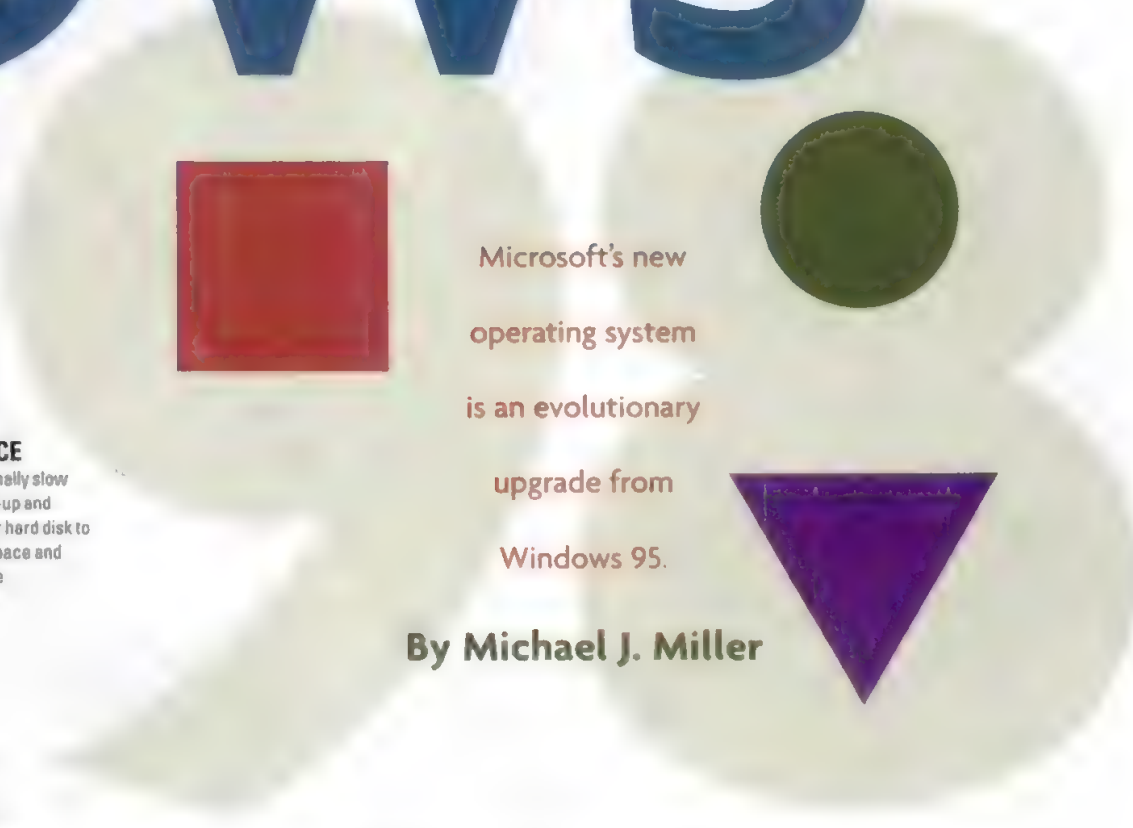
As a major aspect of Windows 98, you can now install USB, FireWire, and DVD peripherals without installing any new software drivers to run them
page 104

FASTER PERFORMANCE

Windows 98 focuses on traditionally slow areas of Windows such as start-up and shutdown. Also, converting your hard disk to FAT32 will conserve hard disk space and improve application loading time
page 112

IMPROVED SYSTEM DIAGNOSTICS

With myriad new and improved tools for tuning up your PC, Windows 98 lets you do everything from scheduling routine system checks to troubleshooting problems.
page 118



Microsoft's new
operating system

is an evolutionary

upgrade from

Windows 95.

By Michael J. Miller

Although Windows 98 isn't getting anywhere near the hype that surrounded the arrival of Windows 95, the upgrade for the popular operating system is attracting a lot of attention. Here, we take an early look to let you know what Microsoft will be delivering. PC Magazine Labs will fully evaluate Windows 98 after it ships (the release is now scheduled for June 25). We'll test things like speed, hardware support, and the upgrade process before making any final recommendations. To sift through the buzz, here's what you need to know.

THE BIG PICTURE

Windows 98 is designed as a consumer operating system. Microsoft is pushing Windows NT for businesses, even though it has more limited support for DOS applications and devices than Windows 95 and 98. (Note that Microsoft has decided to delay releasing Windows NT 5.0 until 1999, so your only option today is Version 4.0.) Windows NT is a better choice than Windows 98 if you don't need the DOS and device support and want an inherently more stable OS. But it requires a larger system (you'll want at least 48MB of RAM) and is really designed for offices with IS departments.

This is the last major upgrade of this style of Windows. Microsoft has announced that after Windows 98, it will base consumer versions of the OS on the Windows NT kernel.

The list price of the Windows 98 upgrade is \$109, and the price in stores should be about \$90. That's the same price as the Windows 95 upgrade, although Microsoft admits that this one is less substantial. It should run on the same hardware as Windows 95, although 486 PCs that can run

Windows 95 may need more RAM and disk space than such systems usually have.

Expect every hardware vendor to upgrade. New end-user machines will be bundled with Windows 98 as soon as it comes out, with many vendors offering free upgrades for machines purchased in the few months before the rollout.

You don't have to upgrade, even if you want new applications. Windows 98 isn't a major architectural change, so all applications written for Windows 98 will run on Windows 95 as well.

THE DEVIL IS IN THE DETAILS

Windows 98 integrates Microsoft's browser, Internet Explorer 4.0, into the OS. Still, you can run Netscape Communicator

or Navigator or indeed almost any application designed for Windows 95.

You'll notice that your views of your hard disk and the help system now appear in HTML in browser windows. By default, you'll notice almost no other differences

from Windows 95, except the IE Channel Bar on your desktop. If you turn on all the interface enhancements, your PC will look almost the same as when running Windows 95 and IE 4.0 with Active Desktop.

Microsoft says Windows 98 will be more

stable. In fact, MS developers claim to have fixed "more than 3,000 bugs." How many this version retains or introduces is an open question.

You'll get more hard disk space if you let Windows 98 convert your hard disk to the FAT32 format. Depending on your files, this procedure can save a fair amount of space, and you can have larger partitions. Microsoft introduced FAT32 with updated ver-

sions of Windows 95 that shipped with other vendors' systems, but this is the first version that will upgrade existing disks. On the downside, FAT32 may be incompatible with older versions of disk utilities; for example, it's incompatible with the hard

*After
Windows 98,
Microsoft will
base consumer
versions of the
OS on
Windows NT.*

What's New in the INTERFACE

Seven mostly Web-related interface features are not exclusive to Windows 98, and fortunately, you can turn most of them off.

If you know Windows 95, you don't have to learn anything new to use Windows 98. The interface of Microsoft's latest operating system is almost identical to its predecessor, and most of the new features won't appear unless you switch them on. In fact, almost all these features aren't new to Windows 98, because Microsoft introduced them back in 1997 in Internet Explorer 4.0's Active Desktop.

When you install Windows 98, it looks like Windows 95 with a few minor additions. Embedded in the taskbar is a new Quick Launch toolbar with four icons: three for Internet-related features and one that hides all windows and redisplay the desktop. A pop-up menu

available from the taskbar lets you add either a toolbar for typing a folder name or Web address, a toolbar with all the icons on your desktop, or a custom toolbar with any icons you choose.

The Start menu lets you access your Favorites folder (also first introduced with Active Desktop). And the Start menu's flyout menus stay visible longer than they did in the Windows 95 default settings, so it's easier to navigate them using the mouse.

Another change that comes from IE4's Active Desktop is that Start menu items have pop-up context menus, so you can modify or delete items simply by right-clicking on them. Under Windows 95, you had to detour to an unintuitive Settings dialog box for

making your changes.

Windows 98 gives you an option that lets you hover over an icon to select it (instead of single-clicking as in Windows 95) and single-click to launch it (instead of double-clicking). This feature makes Windows 98 easier for beginners to learn, but experienced users may feel that Windows seems trigger-happy and overresponsive.

When Microsoft introduced IE4, it trumpeted the fact that Active Desktop let the desktop display live content downloaded from the Web. This feature has largely been a flop, as has the Active Channel bar (which is turned on by default). Microsoft has announced that system vendors can customize the bar, but they can't remove the links to AOL and Disney on the desktop. Most users have found these features more annoying than useful, and you can expect to hear less about them as time goes on.

In general, most of the best features in Windows 98's interface prove to be the same as the best in Windows 95.
—Edward Mendelson

disk compression utility that shipped with Windows 95.

Windows 98 does a better job of supporting USB peripherals, so attaching devices such as keyboards and scanners should be easier. USB devices can be chained, and they share a single interrupt, so you don't have as many conflicts as you can with other devices.

Windows 98 also has improved support for other devices, such as new Plug and Play drivers and FireWire connections.

Windows 98 should be faster in some ways. Most notably, it boots faster, and it rearranges the files on your hard disk so that applications load more quickly. But you won't notice a big overall improvement.

For notebook users, **Windows 98 has new power management features**, such as the ability to power down PC Cards that aren't in use. It also includes a new architecture for power management as well as drivers for 32-bit CardBus devices.

Windows 98 can automatically perform maintenance tasks such as defragmenting your hard disk and optimizing the location of frequently used files. You can set a

time for it to run these tasks routinely.

Windows 98 is designed to be always on, so that it can perform maintenance when you aren't using your computer. And new machines that support OnNow will turn on and off quickly, like a TV does.

The registry is better protected. If you've ever had a corrupt file or installed something that prevented your system from booting, you know how easily you can wreak havoc by accident. Windows 98 tracks your registry, keeping five compressed backups of it and other critical files so you can get back to old versions.

You can have a better view of the information in your system. For example, an improved System Information Utility makes details about such things as your drivers and available IRQs more accessible than ever before.

When files change, **Windows 98 can**

update itself with its Update Wizard, which calls the Microsoft Web site to download the latest changes and any bug fixes.

With an analog or cable TV hookup and a TV tuner card, you can get **WebTV for Windows** as part of the new Broadcast Architecture in Windows 98, which should eventually give you TV enhanced by Web content on your PC.

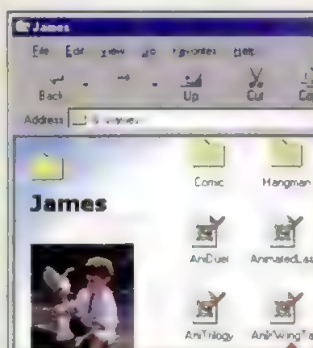
You can have multiple monitors (up to nine) connected to a single machine, provided your computer supports that many video cards. Apple Macintoshes have had this feature for more than a decade. It's a great way to be more productive and to create more dramatic presentations.

In the following pages, we show you how Windows 98 works and go into more detail on the updated features. It's time to start thinking about which OS may be best for you.

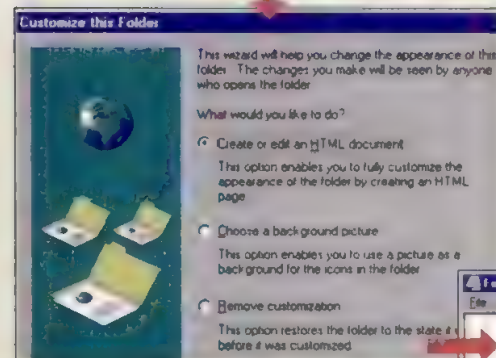
Our Contributors: MICHAEL J. MILLER is the editor-in-chief and EDWARD MENDELSON, JAN OZER, and STEVE RIGNEY are contributing editors of *PC Magazine*. LARRY SELTZER is the technical director of ZD Virtual Labs (www.virtual-labs.com). JAY MUNRO was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

How Folders Act like Web Pages

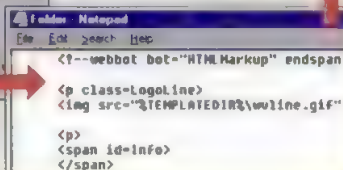
When you view folders in Web style, each one has an information panel on the left and a file list on the right.



You have to edit a complex HTML file in Notepad to customize content. You need to know HTML and JavaScript to modify it. The modified code can include hyperlinks or images as shown here.

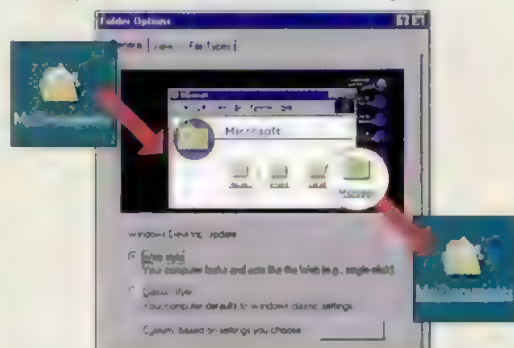


A dialog box lets you customize a folder's content, add a background image, and remove customization.



Single vs. Double Click

To switch Windows 98 to Web style, choose Start | Settings | Folder Options and select Web Style in the dialog box.



Web-style icons are underlined; you can select one by hovering over it and launching it with a single click, as you do with links in a Web browser.

New Desktop Toolbars



Windows 98's new toolbar options include an address bar for opening folders or remote Web sites, your IE4 links toolbar, the Quick Launch bar for easy access to programs, and a bar for your desktop icons.

What's Better about HARDWARE SUPPORT

Five ways that Windows 98 lets you get more use out of your new PC and the latest hardware without installing more software.

New hardware sometimes can mean new hassles in wrestling with installing a device. Windows 98 makes it much easier to use some of the more exciting new hardware devices, such as DVD drives, Universal Serial Bus (USB) scanners and keyboards, and FireWire (IEEE 1394) digital cameras. If you've bought a PC within the last year, you should already have the proper ports to support this new stuff. And now Windows 98 includes all of the drivers you need to use these products without adding any software.

USB and FireWire are specifications that let you daisy-chain multiple peripherals to your computer using external cables, without adding any hardware. They are similar to SCSI, but they can support many more devices. Because Windows 98 includes all of the drivers for such devices, the system will automatically recognize and configure them as soon

as you connect the cable and turn on the power. You can also plug in devices while the system is running.

USB can handle as many as 127 devices and runs at speeds up to 12 Mbps. As a result, it's an excellent choice for adding USB-based monitors, joysticks, mice, scanners, printers, fax machines, and modems. FireWire can handle 63 devices on a single PC, and it is much faster than USB. The current fastest FireWire ports run at speeds up to 200 Mbps, but newer PCs are expected to have FireWire ports that can send and receive data at 1 Gbps in the next year or so. This higher speed makes FireWire ideal for attaching high-bandwidth external hard disks and digital video devices to your PC.

Although you can add a DVD drive to a PC running Windows 95 or some other operating system, you will probably have to install special software drivers to access the device. This process can take hours and

doesn't always work. With Windows 98, DVD will be at the same level of support as CD-ROM. With built-in support for DVD, users can add a drive in minutes and not worry about installing any other software.

Windows 98 also offers other hardware bonuses, such as the ability to attach multiple video cards and monitors to your PC. This feat has been possible on a Macintosh for years, but now a PC user can take advantage of more screen real estate for development or to create a video wall. And multiple-monitor support makes the PC more friendly for graphic arts design, a market that Macs have always dominated. Windows 98 supports up to nine monitors.

Windows 98 also supports Advanced Configuration and Power Interface (ACPI) and Advanced Power Management (APM), specifications for controlling the power on your PC more efficiently. Based on ACPI, the OnNow initiative (led by Microsoft) would let your PC always remain on—although when not in use, it would appear to be off. (See "What's Different for Your Laptop" in this story.)

The improved built-in driver support for these new hardware devices should make for easier peripheral installation, so new PCs with the proper support can be maximized to their fullest potential.

—Steve Rigney

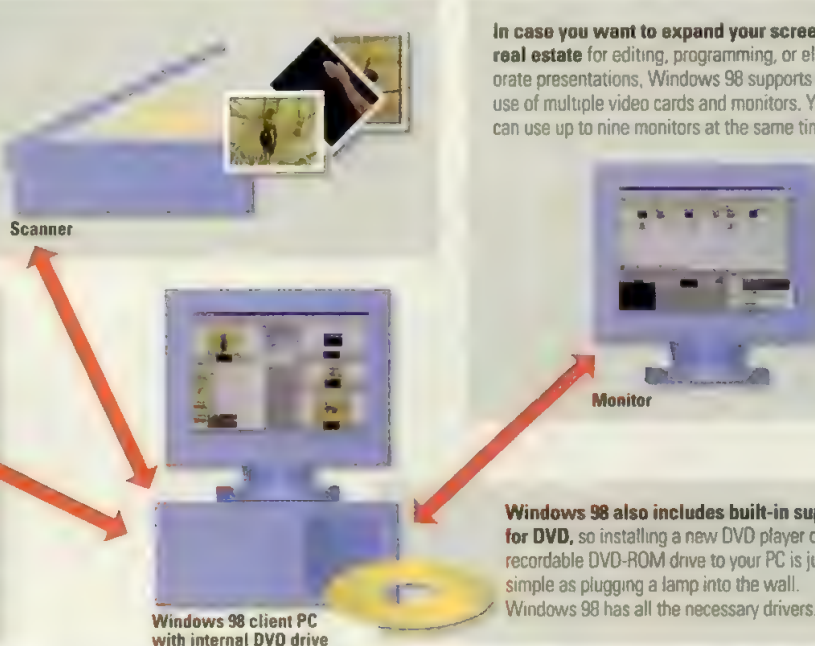
USB, FireWire, and More *Better driver support in Windows 98 makes installing peripherals a snap.*

Windows 98 lets you hook up a Universal Serial Bus (USB) device to your PC. For example, you could use your USB scanner to add old photos to a home-movie project without wrestling with the scanner software first. Windows 98 includes all the necessary drivers for USB devices, so you can even install your device while the PC is running.

Setting up new hardware with Windows 98 is much easier than before. For example, you can connect a FireWire (IEEE 1394) video camera to your PC to input home movies without installing new software, because Windows 98 has all the FireWire drivers preloaded. FireWire is excellent for high-speed data transfer such as video.

In case you want to expand your screen real estate for editing, programming, or elaborate presentations, Windows 98 supports the use of multiple video cards and monitors. You can use up to nine monitors at the same time.

Windows 98 also includes built-in support for DVD, so installing a new DVD player or recordable DVD-ROM drive to your PC is just as simple as plugging a lamp into the wall. Windows 98 has all the necessary drivers.



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What's Faster About PERFORMANCE

Windows 98 seeks to improve five aspects of slow system performance including boot-up, shutdown, and application loading.

Microsoft has attempted to speed up your PC experience with Windows 98, focusing on the areas of running Windows that users sometimes find slow. Some of the changes duplicate the work of utilities that have been available in third-party products for Windows 95, such as Network Associates' Hurricane. But many of them, such as the improvement of system shutdown, are new. We will have final numbers when Windows 98 ships; preliminary tests with late betas of Windows 98 show only slight improvements.

Perhaps the longest, most annoying pauses in Windows use take place at start-up and shutdown. Much of the work that Windows 95 does at these times is redundant or otherwise unnecessary, so Windows 98 attempts not to overdo things. At start-up, Windows no longer initializes every device driver. If a program or the user accesses a device, such as a CD-ROM, Windows will then initialize it.

All device drivers also initialize more efficiently than they did in earlier ver-

sions, which should save time. And Windows 98 supports systems with Fast Boot BIOS, which, in concert with the operating system, tests and initializes various devices only once instead of twice.

The difference in shutdown time in Windows 98 is noticeable. Windows 95 shuts down every device one by one before shutting the system down. Microsoft has realized that it can safely shut down the system without shutting down many of the devices first.

Windows 98 also seeks to improve application-loading speed (see the graphic below). The blocks of code and data in an EXE file don't necessarily load in the same order in which they are stored on-disk; furthermore, loading a program frequently involves reading from multiple files, usually DLLs. Based on technology licensed from Intel, Windows 98 monitors application launching, tracks the order in which the blocks load, and stores that information. When you run Defrag, Windows reorders the blocks so that the program loads sequentially. The system also

determines which applications you use most frequently and puts them on the fastest part of the disk.

Ironically, this technology not only fragments files but intermixes the data from different files—some of which may be shared by other programs. As a result, defrag utilities that are unaware of this technique will see the file system as horribly fragmented and undo all the work.

To take advantage of faster application loading, you need to convert your hard disk to FAT32, which stores information in 4K clusters. It's much more efficient than the older FAT16 format, which used clusters as large as 32K. Depending on your files, this approach can save a fair amount of space; also, you can now have larger partitions. Microsoft introduced FAT32 with system vendors' versions of Windows 95, but this is the first version that can upgrade existing disks.

Another significant improvement in general performance will come from smarter paging. (Paging takes place when the system runs out of memory and the OS moves data to disk.) Windows 98 anticipates such situations and swaps data during idle time, whereas Windows 98 did not.

We'll test these features once Windows 98 is shipping. Today our sense is that none of these improvements will have a dramatic impact on your system performance.—Larry Seltzer

Loading Applications Faster *How Windows 98 can speed up your PC.*

1 Convert your hard disk to FAT32. Go to Start | Programs | Accessories | System Tools | Drive Converter to start the process, which will take a few hours.



2 An executable (EXE) file consists of a series of blocks of code and data, mapped out in the EXE header. They do not necessarily load in physical order. To speed the load process, Windows tracks the blocks' actual loading order.



3 Run the defrag utility. Go to Start | Programs | Accessories | System Tools | Maintenance Wizard to set up a recurring schedule.



4 The defrag utility reorders the blocks in such a way that they load in physical order, thus removing many disk seeks from the process. Windows 98 logically fragments the files so that they load contiguously, which should enable applications to load faster.



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A photograph of a vintage computer monitor on a desk. The monitor has a light-colored bezel with a dark, horizontally-slatted ventilation grille in the center. A desk lamp is positioned to the left, casting light on the monitor. A power cord is plugged into the back of the monitor. The background is dark and indistinct.

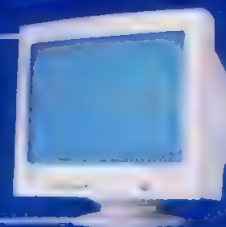
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What's Different for LAPTOPS

Three significant enhancements that will improve remote access and save battery life—if your hardware supports them.

If you ask road warriors what they want from their notebooks, you'll probably hear a torrent of responses centering around two points: longer battery life and faster dial-up access to the corporate office. Windows 98 addresses both concerns. To increase battery life and add other features, Microsoft has built in support for the Advanced Configuration and Power Interface (ACPI) specification, along with Advanced Power Management (APM) 1.2 extensions. Remote-access users will also like being able to use two PC Card modems in a notebook and to aggregate the two dial-up connections, improving performance in situations where they can take advantage of it.

ACPI is a specification that Intel, Microsoft, and Toshiba developed to control power on your PC as well as every device attached to the system. For example, if you connect an ACPI-compliant device (such as a CD-ROM, modem, or PDA) to your notebook, the device will automatically turn your PC on as necessary. Likewise, the notebook can cycle power on an external device when it is needed.

Windows 98 alone will not give you these new features. ACPI is a BIOS-level hardware specification and is dependent on particular hardware. Any notebook with a TX Pentium or LX Pentium II chip set will support ACPI. Older notebooks and most non-Intel x86 CPUs, like AMD's and Cyrix's, do not support ACPI.

At least initially, though, ACPI may consume more battery power than a comparable system running Windows 95, even on an ACPI-compliant system. Once notebook vendors catch up to Windows 98, this problem should be remedied.

APM provides even more features for increasing the battery life for your notebook PC. By supporting APM extensions, Windows 98 can automatically perform tasks such as spinning the hard disk down when it is not being accessed and putting your notebook to sleep after an inactive period. APM's more amazing features include the ability to turn your PC Card modem off when you aren't using the device and turning the modem back on if the line rings.

Windows 98 includes new power man-

agement schemes that let you configure your notebook to conserve power, based on whether it's running on batteries or plugged into an AC outlet. You can create several schemes and switch between them as necessary. This approach may not increase battery life on the best notebooks, but it should help vendors make their notebooks more power-wise.

Though a 56-Kbps connection is fine for surfing the Web, it may not be fast enough for mobile workers who need to access their corporate networks. In an attempt to solve this problem, the developers of Windows 98 have built in the ability to combine the speed of two dial-up modems. This feature is called Multilink Channel Aggregation, and it will work with both analog and ISDN modems. Although the latest service update of Windows 95 includes the Multilink Channel Aggregation component, the ability to access two PC Card modems simultaneously in a single notebook is a new feature in Windows 98.

But Multilink Channel Aggregation isn't perfectly suited for laptop use. You need two phone lines and two jacks to use it; in other words, your home or a hotel needs to be set up appropriately. You also need PC Cards that use dongles rather than X-Jack connectors, or else you won't have room for both cards and both connectors.

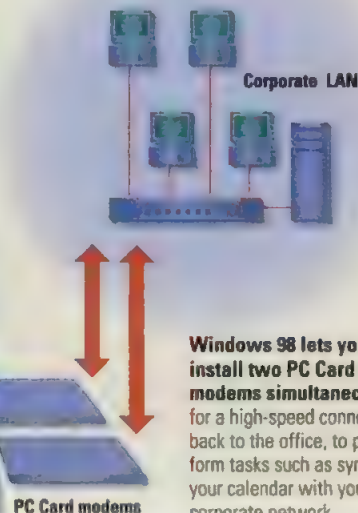
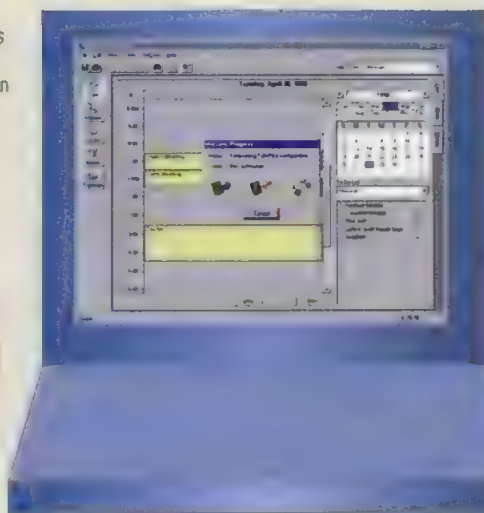
For those who can take advantage of the enhancements for laptop users, Windows 98 may be a worthwhile upgrade for these features alone.—SR

Portable Power *New specs give your laptop better connectivity.*

Windows 98 supports ACPI, a spec that lets the PC and peripherals turn each other on and off as necessary. An ACPI-compliant device can automatically turn your Windows 98-enabled computer on for a certain task; for example, your PDA can turn the PC on to sync its own calendar with the system calendar.



PDA



Windows 98 lets you install two PC Card modems simultaneously for a high-speed connection back to the office, to perform tasks such as syncing your calendar with your corporate network.



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What's Improved in SYSTEM DIAGNOSTICS

Windows 98 has 12 new or improved utilities that will help you keep your PC running smoothly, including detailed reporting tools and problem-solving wizards.

The first Windows version with the ability to repair itself, Windows 98 has many built-in maintenance features that third-party utilities don't match. A new Automatic Skip Driver Agent shuts off drivers that fail to load during three consecutive boots, and a new Registry Checker automatically restores a functioning copy of the registry when a new installation corrupts it so badly that the system won't boot at all. When an installation program overwrites newer versions of Windows system files, the Version Conflict Manager puts the overwritten files in a backup directory and lets you restore them later.

The control center for all these and other programs is the massively detailed

Microsoft System Information Utility, accessible from the Start menu. From this program's Tools menu, you can access the System File Checker—a program that checks Windows system files for corruption or changes and optionally restores the originals—as well as the disk-surface checker ScanDisk. You also get an enhanced version of Dr. Watson, a program that records the system state after a program crash. For example, you can easily see the status of all IRQs, memory allocation, and DMA channels—information not readily available previously when a problem arose in installing hardware.

Windows 98's System Configuration Utility provides centralized control over

which programs and settings are loaded during boot-up. You can see things that are not visible in the Start-up menu in Windows 95.

Updated versions of Windows system files used to be available only to advanced users who manually downloaded them from Microsoft's Web site. Windows 98 changes all that with its Windows Update. Windows Update connects to Microsoft's Web site through Internet Explorer, scans your system for files that can be updated, and downloads changes over the Internet after asking for your approval.

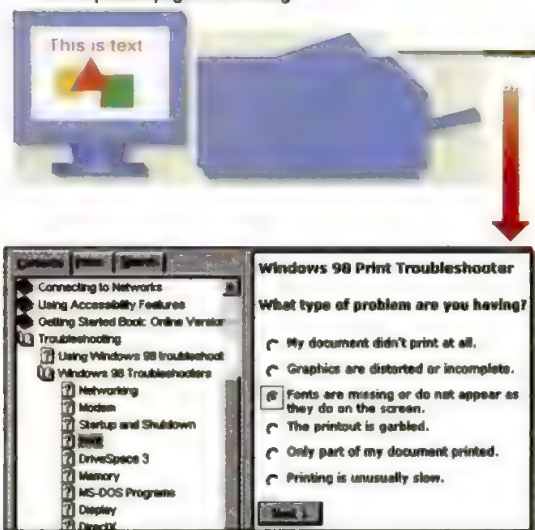
For everyday use, a Maintenance Wizard lets you schedule regular disk checking with ScanDisk, disk optimizing with Disk Defragmenter, and cleanups of temporary and other unneeded files with the new Disk Cleanup.

Third-party utilities such as Network Associates' Nuts & Bolts and Symantec's Norton Utilities include disk-repair and registry-maintenance features that Windows doesn't include. But Windows 98 is the Windows version with the most impressive set yet of built-in utilities.—EM

Windows 98 Troubleshooting *PC self-service, step by step.*

1 When a problem arises with your PC, the Windows 98 Troubleshooters can walk you through the glitch and help you solve it. Here the correct fonts appear on-screen, but the printed page looks wrong.

This is text



2 To begin, go to Start | Help, click on the Contents tab, and choose Troubleshooting. From the Windows 98 Troubleshooters list, choose the function you need help with, such as Print. Select which option best describes your problem and click Next.

Is the problem occurring with TrueType fonts?

To determine whether your font is TrueType

1. Click Start, point to Settings, and then click Control Panel.
2. Double-click Fonts.
3. Find your font and check for a TT symbol next to it.
 - A TT symbol means you are using a TrueType font.
 - No symbol or some other symbol indicates a non-TrueType font.

- ☒ Yes, I am printing TrueType fonts.
- ☐ No, I am not printing TrueType fonts.
- ☐ I don't know.

3 The next menu offers a hypothesis for your problem and walks you through the process. Here, you would determine whether you are using a TrueType font before moving on.

- If the font that you wish to reinstall did not come with Windows 98, it may be difficult or impossible to reinstall without reinstalling the program that came with the font. If you are unsure of the location of the font, do not follow the steps below.

To reinstall your font

1. In the Fonts folder, right-click your font.
2. Click Delete.
3. On the File menu, click Install New Fonts.
4. Use the Add Fonts dialog box to reinstall your font.

Did this action solve the problem?

- ☒ Yes.
- ☐ No.
- ☐ I'd like to skip this step and try something else.

4 Now that you've identified the problem, the Troubleshooter can suggest a solution, guiding you through the process of solving it. Then you let the Troubleshooter know whether the solution has succeeded. If you select Yes, the Troubleshooter closes. If you choose No, the next screen suggests you visit Microsoft's Web site for further suggestions.

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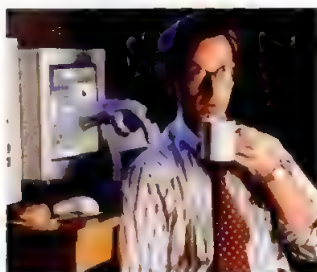
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Windows Magazine, 3/97

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Windows Magazine, 3/97



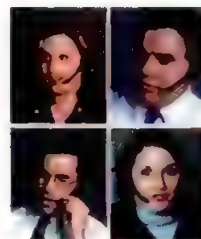
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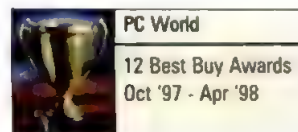
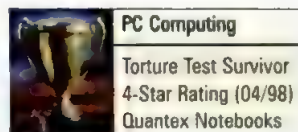
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QP6/266 SB-1c (w/ Intel® Celeron® processor)... \$1149

QP6/266 SB-1 (w/ Pentium® II Processor)... \$1249

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- Intel740™ AGP Graphics with 8MB SDRAM
- Upgrade to 3D Labs Permedia 2 w/8MB SGRAM for \$49
- 17" Digital Monitor (15.8" viewable)
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- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
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- MS Office 97 Small Business Edition
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QP6/300 SB-2 (w/ Pentium® II Processor)... \$1649

QP6/333 SB-2 (w/ Pentium® II Processor)... \$1749

QP6/350 SB-3 \$2099

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- Upgrade to 3D Labs Permedia 2 w/8MB SGRAM for \$49
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QP6/333 SB-3 (w/ Pentium® II Processor)... \$1899

QP6/400 SB-3 (w/ Pentium® II Processor)... \$2299

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Business lease: \$91/Mo.

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- Quantex ATX Mid Tower Case
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QP6/300 SB-4 (w/ Pentium® II Processor)... \$2049

QP6/333 SB-4 (w/ Pentium® II Processor)... \$2199

QP6/350 SB-4 (w/ Pentium® II Processor)... \$2399

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Quantex H-1210 \$1949

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- 2GB HD / 3.5" 1.44MB Modular Floppy Drive
- PCMCIA K56flex protocol Fax/Modem*
- 24X Modular CD-ROM Drive
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- Smart Lithium Ion Battery
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- Integrated Personal Touchpad
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H-1210 w/200MHz Pentium processor w/MMX Technology... \$1879

Quantex H-1411 \$3499

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- 512KB Secondary Cache
- 4GB HD / 3.5" 1.44MB Modular Floppy Drive
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- Integrated 16-bit Stereo Sound and Speakers
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H-1411 w/233MHz Pentium II processor... \$3249

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QP6/333 SM-3x \$1999

Lease: \$70/Mo.

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- 64MB SDRAM Memory / 512KB Secondary Cache
- 4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
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- 17" Digital Monitor w/NEC ChromaClear CRT (15.9" viewable, 25 dp, 1600x1200 max. resolution)
- 100MB Internal Zip Drive with one cartridge
- K56flex protocol Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- Ensoniq 32-Bit Wavetable Sound Card
- Altec-Lansing ACS-45 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 95/FREE Upgrade to MS Windows 98*
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- Microsoft Office 97 Small Business Edition
- 3-year limited warranty with 1-year On Site Service**
- QP6/266 SM-3X (w/ Pentium II processor)... \$1799
- QP6/300 SM-3X (w/ Pentium II processor)... \$1899
- QP6/350 SM-3X (w/ Pentium II processor)... \$2199

QP6/400 SM-4x SE \$2999

Lease: \$105/Mo.

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- Intel740™ AGP Graphics with 8MB SDRAM
- 19" Digital Monitor (18.1" viewable)
- 100MB Internal Zip Drive with one cartridge
- K56flex protocol Fax/Modem* w/Voice Mail and Speakerphone
- 2nd Generation DVD-ROM Drive w/Decoder Board
- Ensoniq 32-Bit Wavetable Sound Card
- Altec-Lansing ACS-490 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 95/FREE Upgrade to MS Windows 98*
- Power Multimedia Software Bundle
- Microsoft Office 97 Small Business Edition
- 3-year limited warranty with 1-year On Site Service**
- QP6/300 SM-4x SE (w/ Pentium II processor)... \$2499
- QP6/333 SM-4x SE (w/ Pentium II processor)... \$2599
- QP6/350 SM-4x SE (w/ Pentium II processor)... \$2799

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What's Cooler About MULTIMEDIA

Eight enhancements that better integrate the multimedia architecture into Windows, including Broadcast Architecture.

Multimedia enhancements were among the key improvements in Windows 95; Windows 98 represents a more modest change. Its most dramatic new feature is Broadcast Architecture—Microsoft's integration of a platform for watching TV on your PC, which just may be the Trojan horse delivering Microsoft into your living room. Beyond that, Windows 98 offers a number of useful, evolutionary plumbing changes that should make your system more DVD-friendly and more stable.

To help you see Broadcast Architecture's potential value, Windows 98 bundles in WavePhone's broadcast service Wave-

Top (www.wavetop.net). It uses Broadcast Architecture to supply rich multimedia content from the likes of CBS SportsLine and Quote.com for off-line viewing.

Windows 98 comes with the latest versions of DirectX (the multimedia architecture for Windows) and DirectShow (the playback component). The most significant new component of DirectX is the DVD support in DirectShow. This is convenient for both vendors and users, but most of the other benefits of DirectX will still accrue to Windows 95 users, who can install these components themselves.

Windows 98 will also provide a few enhancements under the hood to

improve performance in video and other streaming media. Kernel-mode streaming reduces the load on the CPU and decreases latency. Windows Quality of Service lets users reserve network bandwidth for more intensive applications, such as videoconferencing.

The final multimedia enhancement in this release of Windows 98 is support for the MMX instructions in all Pentium II and Pentium MMX processors and compatibles. Its significance appears to be minimal, though developers will be able to take advantage of MMX processors using the DirectX API.

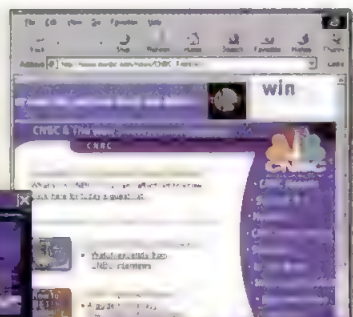
Some larger multimedia enhancements are on the horizon for Windows 98, but the version available on June 25 will not include them. Chrome is a new platform that promises better-quality DVD, CD-ROM, and Web-enhanced multimedia for high-end systems (350-MHz Pentium II PCs and better). It should be available in early 1999, and service updates of Windows 98 will include it.—Jan Ozer

TV on Your PC *Windows 98 integrates TV and the Web for an enhanced experience.*

1 **Input into Windows 98 Broadcast Architecture** can come from traditional analog and cable TV inputs, which you access through a required television tuner in the PC. At this time, Windows 98 cannot receive satellite television broadcasts.

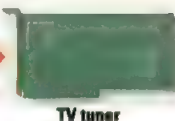
3 **The Windows 98 Program Guide** integrates all channels from your cable or antenna-based system. This version does not, however, comprehend Internet channels configured into a browser. When a program has interactive content, Windows 98 enables a special icon

4 **Individual broadcasters** can send program-related HTML data—with the analog signal—which is read by your browser



2 **The television tuner accepts analog television inputs** and digital data stored in the signal's vertical blanking interval (VBI). You don't need a modem or another Internet connection

to receive data delivered through the VBI. You will need Internet connectivity to access information linked to the broadcast HTML.



TV tuner

5 **You can use the TV tuner to watch television on your computer.** Tuner functionality varies with individual products. For example, ATI Technologies' All-in-Wonder lets you capture or monitor the closed-captioned text feed separately from the video, launching a show on your PC when specified words are mentioned.

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Mitsubishi LCDs	LCD40	LCD50
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Dimensions (H.W.D)	14.7 x 14.0 x 6.3"	15.4 x 14.7 x 6.3"
Brightness	180 cd/m ²	220 cd/m ²
Viewing Angle	160°/140°	160°/140°
LCD Type	TFT Active Matrix	TFT Active Matrix

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What's Easier for DEVELOPERS

Two new options to write Windows scripts and device drivers make developers more productive.

Windows 98 offers developers two new ways to write programs. The Windows Scripting Host (WSH) will likely prove more popular, but the Windows Driver Model (WDM) may be more significant, as it lets developers write only one set of drivers for both Windows 98 and Windows NT.

The WSH is the batch-processing language that Windows has never had. Although Microsoft has included it with the Windows NT Option Pack (an add-on for Windows NT Server), the WSH has not had all the abilities it now has under Windows 98. In Windows 98, the WSH can script arbitrary system objects, including special objects in the shell and file system. (It will eventually have this capability in Windows NT 5 as well.) Internet Explorer 4.0 includes the same scripting engine.

When using the WSH, programmers have access to a standard set of system objects, such as the registry and standard folders and network connections. You can write programs to manipulate them.

The program can manipulate any scriptable ActiveX control in the system. For example, you can write a script to search the file system for all Microsoft Word files, open each one, and change an element of content or formatting in a uniform way. The WSH should also be popular for maintenance scripts, such as a script for deleting time-stamped files before a certain date.

WINDOWS DRIVER MODEL

The WDM is a model for device drivers that can run on both Windows 98 and Windows NT. Moving hardware vendors to the WDM is important for Microsoft to fill in

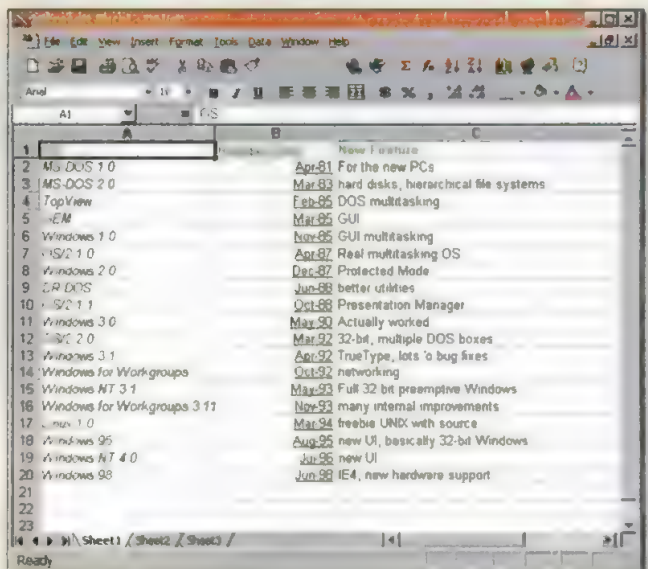
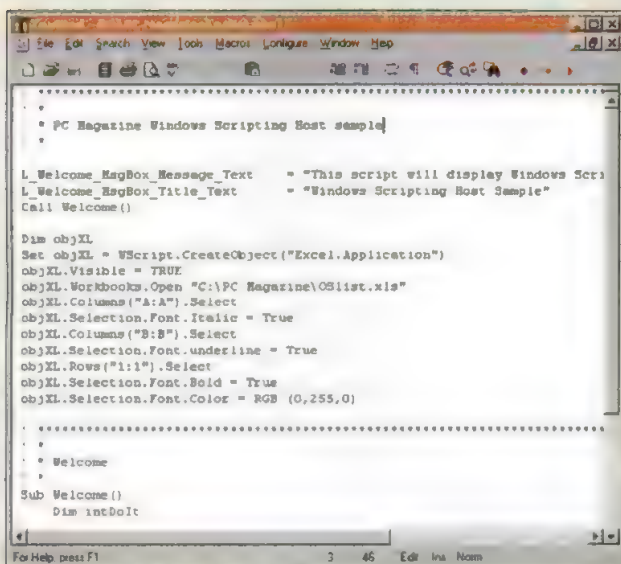
device-support gaps in Windows NT, since WDM drivers are the same files for both operating systems. The WDM will also make a transition from Windows 98 to a version of Windows NT much smoother for both users and hardware vendors.

The WDM supports four classes of devices. The stream class supports kernel-mode streaming of data for video capture, MPEG decoders, audio, DVD-ROM, and broadcast architectures. The HID-class drivers support input devices such as joysticks and keyboards; the USB class drivers and IEEE 1394 class drivers support controller hardware for those buses. The WDM doesn't support all device classes—for example, it doesn't support graphics cards—but most non-WDM devices already have good Windows NT support.

You can write WDM drivers in two ways. For most drivers, you can leverage a Microsoft-supplied WDM driver and provide a device-specific minidriver or a set of parameters for the driver to use in controlling the device. If a device does not fit into one of the predefined classes, you will definitely need to write a more traditional monolithic driver that is Windows 9x- or Windows NT-specific.—LS PC

New Scripting Tools *Windows Scripting Host lets you manage routine tasks.*

Windows Scripting Host (WSH) programming is much like script programming in a Web page. This script, which opens and formats an Excel spreadsheet, is written in VBScript. WSH programs can be in JavaScript or a third-party Active Scripting language such as Perl, Python, or REXX.



Windows Scripting Host scripts can create and open files and manipulate the object models of other applications. Above, we select various Excel cells and change their formatting.



e-business



IS THERE MORE TO JAVA THAN COFFEE JOKES?

Two years ago, the introduction of Java™ software created a whirlwind of excitement and an explosion of coffee-oriented puns. Was it all hype?

At IBM, we think Java is worthy of the stir it created. An idea that brings two benefits to businesses wishing to become e-businesses: one is faster application

development, the other is the promise of standards and open connectivity.

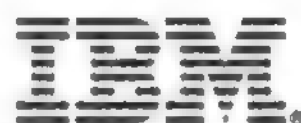
Perhaps the most profound change that the Web has brought to the IT world is a culture of standards. It's this capability that permits universal connectivity and has allowed 80-million-plus people to access the Web. Java is the first language that allows a single application to run on any platform (write once, run anywhere™).

This can speed the application development process – since you don't have to create a different version of your software for every client, every server and every browser. And since most business environments contain a wide variety of computing platforms, Java is just common sense. So is the idea of 100% Pure Java™ – a Java that is not corrupted by offshoots and OS dependencies. (We support Sun™ on this issue.)

Is Java perfect? No. Not yet. Like any new technology, it needs refinement. But it's maturing faster than any other language in history and IBM is working to make it real. Currently, we have more people working on Java than any other company – creating real-world applications in finance, manufacturing and distribution (to name a few). And we're putting Java to work to solve real business problems.

We're also creating award-winning tools like VisualAge® software and Lotus Bean Machine™. These are powerful, flexible programming tools that make it easier for all kinds of companies to build customized solutions (everything from interactive customer service Web sites to collaborative intranets).

To learn more about how IBM and Java can help your business become an e-business (and enjoy one or two fresh coffee puns), we invite you to check out our Web site at www.ibm.com/java or call us at 1 800 IBM 7080, ext. NC39.



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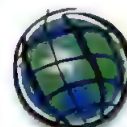
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- 1 Management software, such as Intel's LANDesk Client Manager, displays the information in the service layer in a user-friendly GUI format.
- 2 The service layer, a piece of code defined by the DMI standard, collects all system information from the component layer and stores it in MIF files.
- 3 The component layer gathers information and centralizes that data.
- 4 Data is gathered by various disparate elements, including the system BIOS, OS, and hardware such as an ASIC that monitors the fan, voltage, and temperature



IN THIS REVIEW

Aberdeen LLC	152	Comtrade Inc.	158	Hymco Technologies Inc.	162	NEC Computer Systems Division	168
Acer America Corp.	152	Dell Computer Corp.	158	Maximus Computers	162	NexTrend Technology Inc.	170
ACMA Computers Inc.	152	Digital Equipment Corp.	159	Mega Computer Systems	164	Polywell Computers Inc.	170
All Computer Technology	154	DTK Computer Inc.	159	Micro Express	164	Premio Computer Inc.	172
American Multisystems	154	Everex Systems Inc.	160	Micro X	164	ProGen Systems	172
Calliber Computer Corp.	154	Hertz Computer Corp.	160	Micron Electronics Inc.	168	Quantex Microsystems Inc.	172
Compaq Computer Corp.	158	Hewlett-Packard Co.	160	Monorail Computer Corp.	168	Reason Computer Inc.	173

ged order & flexibility in one package

PCs

By Cade Metz

GET ONLINE!
See downloadable test results from the 38 corporate managed systems we tested, ranging in speed from 333 MHz to 400 MHz.
www.pcmag.com

As it stands, desktop management needs a bit of managing itself. Though a two-year-old Gartner Group study concerning the total cost of PC ownership still has industry pundits advocating DMI Service Layers and chassis intrusion alarms, such desktop management—as provided with today's corporate PCs—is

only the beginning. The DMI standard and corresponding implementations are still evolving, and in most cases what you get with the PC is a first step that when combined with a good central management package can deliver the benefits you seek.

Earlier this year, in "The New Networked Computers" (*PC Magazine*, May 5, 1998), we examined the state of NetPCs, thin clients, and Java-based NCs—three reduced-hardware machines meant to facilitate centralized management and to lower TCO. For this, our annual summer roundup of PCs, we test 38 variations on fully equipped managed desktops. Though capable of standalone use, each belongs in a large local area network. All are equipped for remote desktop management.

REVIEW CRITERIA

We asked for systems with a minimum 333-MHz Pentium II processor. Of the 38 machines we tested, 9 run at 400 MHz; 7 at 350; the rest at 333. Whereas the 333-MHz chip still uses the older 66-MHz system bus, the 350s and 400s benefit from Intel's BX chip set, which interfaces with main memory at 100 MHz (for more on the latest Intel silicon and the 100-MHz bus, see "400-MHz Pentium II PCs," *PC Magazine*, May 26, 1998).

Each machine had to have 64MB of main memory, a 4GB or larger IDE hard disk, a graphics adapter with at least 4MB of memory, a 24X CD-ROM drive or faster, and a 17-inch monitor or larger. Because

Royal Computer Inc.	173	Information Systems Inc.	178
SAG Electronics	173	Total Peripherals Inc.	180
SIA Computer Corp.	174	XI Computer Systems	188
Sys Technology Inc.	174	Zenon Computer Systems Inc.	189
Tangent Computer Inc.	176	Price/Performance Index	128
TigerDirect Inc.	177	Glossary of Management	
Toshiba America		Initiatives	130

price/performance index: managed PCs

The extra work needed to provide ample technical support and create a solid managed corporate PC pushes up the price of some well-managed solutions. There are several solid values to be found, however.

Two 400-MHz systems tied for the top performance/features score: the Dell OptiPlex GX1 (\$2,803 direct) and the NEC PowerMate 8100 (\$3,200 street). Both systems offer strong performance and tool-free cases. The Dell system used Dell's own OpenManage software, which allows it to offer some extra management features such as remote BIOS updates. The NEC unit has a good implementation of LANdesk Client Manager.

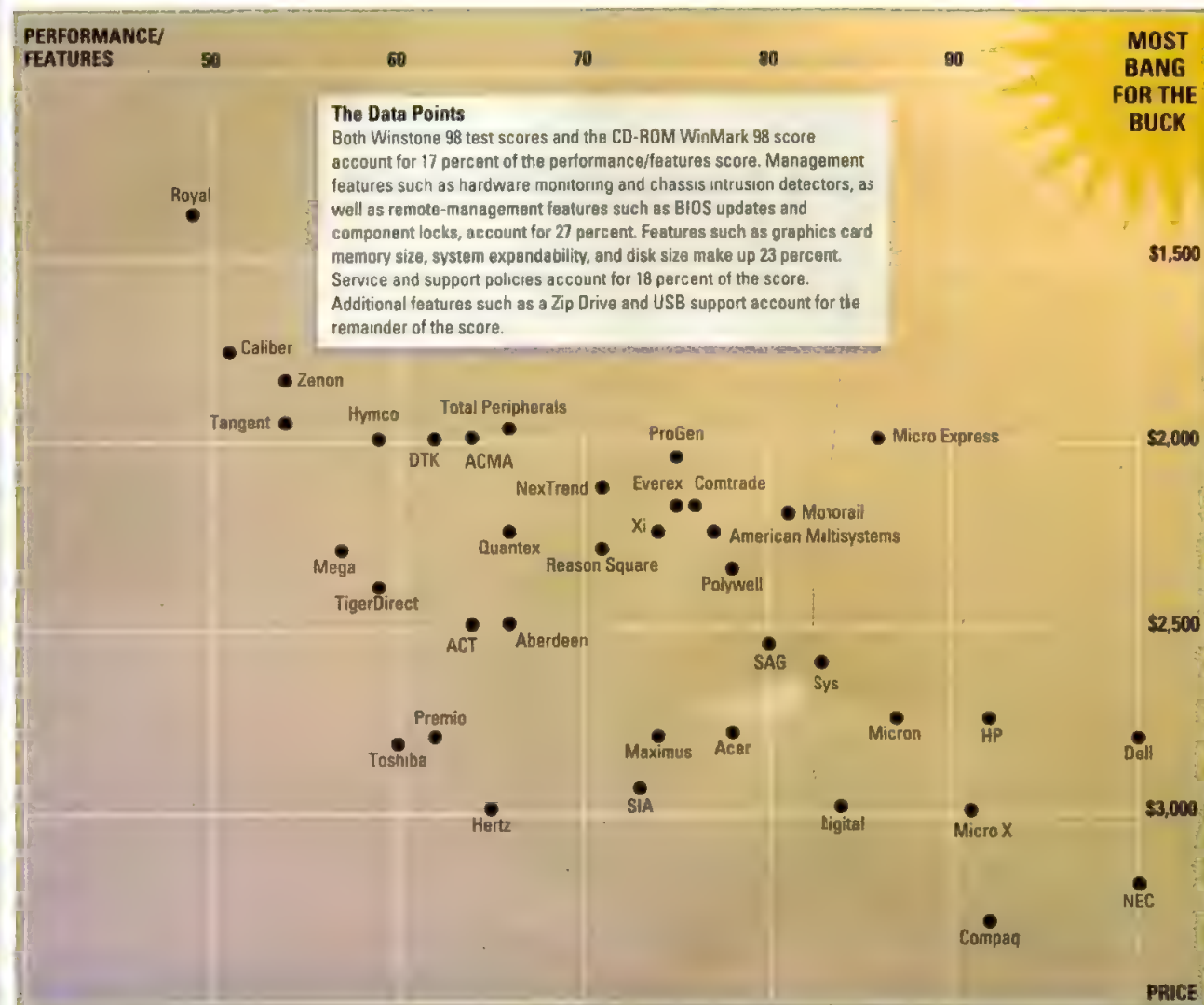
Our Editors' Choice, the HP Vectra VL Series 8 (\$2,750 street) adds excellent hardware design and robust desktop

management capabilities to top-notch performance. It comes with a Pentium II/400 CPU and HP TopTools; management features, such as remote BIOS updates and remote component locking, are in excess of what you'd find in a generic solution.

Closest to the sweet spot on our chart is the Micro Express MicroFlex-PII/333 (\$2,000 street), which represents an impressive value in a DMI 2.0-compliant PC. While the Pentium II/333-based unit doesn't offer a case lock, it does provide an intrusion detector and adds such features as a DVD-ROM drive.

If you're looking for a 350-MHz system, you'll notice the ProGen Venture Pro 350 (\$2,049 direct), which does all of the basics well and offers excellent performance for its CPU class.

The Micron ClientPro 400 (\$2,749 direct), which comes standard with ECC SDRAM, offers top performance in addition to its solid implementation of LANdesk Client Manager.—Analysis written by Robert S. Anthony



editors' choice

• HP Vectra VL Series 8



Managed PCs need more than speed. They must offer ease of servicing plus comprehensive asset-management

and inventory tools. Our Editors' Choice, the HP Vectra VL Series 8 (\$2,750 street) offers all that and more. The system comes with all the power you could want: a 400-MHz Pentium II CPU, SDRAM, a 10.1GB Ultra ATA-3 IBM hard disk, and integrated Matrox graphics with 4MB of SGRAM. All these components add up to terrific performance, and that's just the beginning.

This unit boasts such management features as hardware monitoring (fan and voltage only, though other Vectra models also monitor temperature), a chassis intrusion detector, remote LAN wake-up, and remote power-on/off. You can handle both updating the BIOS and, for greater security, locking such components as the hard disk, keyboard, and floppy disk drive remotely. Through Hewlett-Packard's DMI-based TopTools, you'll be able to see and control all your system's assets in a user-friendly GUI.

these are corporate systems, we asked for 10/100 Ethernet adapters and Microsoft Windows NT 4.0. Each unit had to have a desktop management package—such as Intel's LANDesk Client Manager (LDCM)—that supports DMI 2.0 (Desktop Management Interface), the latest specification.

Gateway's newest E-series PC, which uses an LDCM solution, was not available in time for this review. IBM also could not provide a unit in time for testing, but it offers an innovative solution, discussed below.

PERFORMANCE

On the average, the 400-MHz systems scored 14 percent higher than the 350-MHz models under ZD Business Winstone 98, and the 350s bettered their 333-MHz counterparts by only 3 percent. But relative performance isn't as relevant here as it would be if we were reviewing professional/enthusiast machines, such as in our inaugural 400-MHz roundup. The key to managed PCs is their management software and hardware and the serviceability of their chassis designs. You should certainly bypass an inordinately slow system, but most performance differences among these PCs cannot be discerned with the naked eye.

SERVICEABILITY

The aptitude of a corporate PC begins with its chassis design. The ideal corporate chassis is easily opened, and its major hardware is easily serviced to make upgrades and repairs quick and painless. An IT administrator should have the luxury of being able to remove a system's cover without a screwdriver and promptly access its CPU, main memory, disk drives, and expansion cards.

The system's tool-free case is designed for ease of servicing. Hewlett-Packard provides a three-year warranty; technical support is available during extended business hours.

We were also impressed with the Micron ClientPro 400 (\$2,749 direct), which earns an honorable mention. This 400-MHz unit came with Intel's LANDesk Client Manager 3.1 and offers full hardware monitoring of fan, temperature, and voltage, as well as a chassis intrusion detector, remote LAN wake-up, and remote power-on/off. Remote BIOS updating is also available. Its case is tool free; all components are accessible. Its 10.1GB hard disk and Diamond Viper V330 AGP card helped it earn some top scores. Micron provides a three-year parts, one-year labor warranty and 24-hour tech support.

For those searching for a bargain, we recommend the Micro Express MicroFlex-P11/333 (\$1,999 direct), which also earns an honorable mention. This unit comes with all the manageability features you need (save for a tool-free, lockable chassis) and good performance to boot. This Pentium II/333 system came with an 8MB Number Nine Revolution 3D AGP graphics card and 4.3GB Quantum Fireball hard disk. Micro Express covers the systems for four years and has 24-hour technical support.

The management solutions in the Compaq Deskpro EN Series (\$3,330 street) and the Dell Optiplex GX1 (\$2,803 direct) are also excellent. Corporate buyers will not be disappointed in either machine.

In a tower case, you have lots of room and can reasonably expect all components to be readily accessible. Machines using smaller desktop or even mini-tower cases require more thought. Well-designed machines use a slide-out motherboard, as in the NLX design, and have drive bays that can swing out of the way for easy access to underlying components. Cables should be neatly tied.

If servicing a machine takes less time, you can concentrate on other network administration tasks. That said, most vendors covered here do not offer an easily accessible chassis. Familiar makers including Compaq, Dell, Digital, HP, and NEC are generally the ones that offer such a chassis.

The ultimate corporate box must also afford adequate room for expansion. An open ISA slot remains important for legacy hardware, but most systems should provide two to three available PCI slots. Most of today's expansion cards use the PCI bus. By the middle of next year, when Microsoft and Intel enforce their PC99 spec, ISA will have left the desktop entirely.

Though PCI-based graphics adapters are still prevalent, the high-end market will in all likelihood fully transition to the faster dedicated graphics bus, AGP (Accelerated Graphics Port), over the next year. Of the 38 systems reviewed here, 32 use AGP cards, while 3 others put PCI graphics cards alongside unused AGP slots. With these machines, you can upgrade to later generations of AGP simply by adding a card. Four remaining systems—from Acer, Dell, HP, and Toshiba—have AGP integrated on the motherboard and therefore lack AGP ports, forcing you to purchase a new machine when in need of an AGP upgrade.

glossary of management initiatives

The number of management initiatives—and accompanying acronyms—are steadily growing. Below is a quick guide to some of the more significant proposals by industry leaders.

ACPI Advanced Configuration and Power Interface. A specification defining a new interface to system boards that allows the OS to direct power management and system configuration.

PC98 PC design guide for 1998-99 coauthored by Intel Corp. and Microsoft Corp. with aid from other industry vendors, covering the PC system, bus, and devices. It includes guidelines for various types of mobile PCs for the first time, new requirements for manageability and remote boot-up support, and new specs for IEEE 1394, among others. The basic PC98 PC should have no ISA devices; PC99 is

expected to do away with ISA slots as well.

WfM Wired for Management. An Intel-led initiative to define guidelines to make Intel-compatible systems more manageable. It supplements the DMI spec and covers asset management, remote configuration/reconfiguration, and remote wake-up and power management features.

WBEM Web-Based Enterprise Management Initiative. Standard being developed by BMC Software, Cisco Systems, Compaq, Intel, and Microsoft to allow management data from a variety of sources (DMI, SNMP, OS, and others) to be described, accessed, and reported by management applications regardless of the original source of that data. Aims to be platform independent.

ZAK Zero Administration Kit for Windows NT workstations. Tools and methodologies for IT managers and OEMs to simplify the implementation of secure management of Windows NT, enabling administrators to easily restrict user access to parts of the client.

ZAW Zero Administration initiative for Windows. A Microsoft-spearheaded initiative focused on making Windows and Windows NT systems more manageable through greater centralized control and automation of administrative tasks.

REMOTE MANAGEMENT

Though tractable chassis designs and easily upgradable hardware do indeed reduce TCO, remote software-based management—when properly implemented—is even more beneficial. If administrators can use their LAN connections to remotely wake a system up, update its BIOS, track its assets, monitor its health, and distribute software, they can save still more time while cutting down on hardware theft. Unfortunately, a few of these functions typically require third-party software not provided with some desktop management software packages, such as Intel LDCM.

Each machine reviewed here is compliant with the DMI 2.0 spec, meaning you can inventory at least some of its components from a remote console. Most offer remote LAN wake-up technology, which allows systems to detect an incoming LAN packet, “wake” themselves up, and be ready for further instructions and some form of health monitoring. Only a few provide remote BIOS updates or remote component locking without an additional application, however. None natively allow remote software distribution without a LAN or enterprise-level package. (See the sidebar “The State of Desktop Management”.)

The Compaq, Dell, Digital, and Hewlett-Packard systems come with proprietary management software: Insight Manager, OpenManage, ClientWorks, and TopTools, respectively. The other 34 PCs bundle versions of LANDesk Client Manager, licensed from Intel. All five packages have two components, one for the client and the other for the remote administrator.

ClientWorks’ remote half and the administrator components for LDCM, OpenManage, and TopTools are available either bundled with the client systems or available for download on the Web. The Insight Manager administrator is typically acquired by purchasing a Compaq server.

ASSET MANAGEMENT

Many LDCM PCs don’t supply a complete list of system components. If you simply load LDCM on a Windows NT system with-

out doing any customization, it gives you information on disk drives, main memory, system files, the graphics card, and the network card. For more extensive data, a vendor must do additional coding, either in a management information format (MIF) file or the DMI component interface.

The effect of remote DMI inventory may vary; if all of your users are on-site, it may not make much difference. If you have multiple sites to administer or your users are on multiple floors, you may find it more useful. DMI tracking can also be used as a theft deterrent; the effectiveness of this is difficult to gauge.

Other features, such as health monitoring, are clearly beneficial, but they aren’t nearly as welcome as remote LAN wake-up, remote BIOS updates, and (arguably) remote software distribution. Since no corporate PC provides all of these functions natively or with the included desktop management software, your best option is to augment LDCM or one of the proprietary packages with a larger desktop or enterprise management tool.

Several packages, including Microsoft SMS and Symantec’s Norton Administrator Suite, are good choices for such augmentation. They expressly provide tools for remote control, hardware and software inventory, software installation, and (in some cases) virus protection. These packages allow centralization of the inventory data and preparation of reports, whereas LDCM does not. Other packages, including Intel’s LANDesk Configuration Manager and ON Technology’s ON Command Comprehensive Client Manager, afford remote operating-system distribution as well, allowing you to manage new clients

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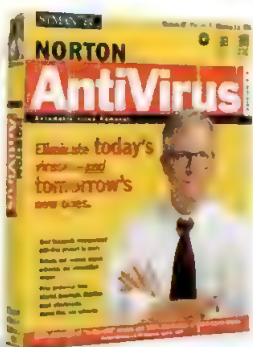
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the state of desktop management

Standardization does not always mean simplification. Most major PC vendors have adopted the latest Desktop Management Interface (DMI), a standard method of examining a machine's components via software. Yet applied desktop management is still irregular and obscure, and needs to develop further to be truly useful in a mixed vendor environment. All 38 systems reviewed here are DMI 2.0-compliant, yet their management solutions differ markedly in look, ability, and practicality.

The machines from Compaq, Dell, Digital, and Hewlett-Packard come with proprietary solutions (Insight Manager, OpenManage, ClientWorks, and TopTools, respectively), while the other 34 use Intel's LANDesk Client Manager (LDCM) 3.0, 3.1, 3.2, or 3.3 licensed from Intel. If you add IBM's managed solution, which augments LDCM with several proprietary capabilities but was not included in our roundup, then the state of bundled desktop management is even more complex.

Some functions are useful; others trivial. To truly manage your client system and significantly reduce total cost of owner-

ship, you must augment these packages with a third-party desktop management suite such as Microsoft SMS or an enterprise management suite in the vein of HP OpenView. (See the included chart for a list of the most popular enterprise and LAN management suites and check which desktop management software offers plug-ins for those packages).

THE FUNCTIONS

Desktop management, as supplied by these five bundled solutions, can be separated into seven distinct functions: DMI querying, health monitoring, chassis intrusion detection, remote system wake-up, remote BIOS update, component locking, and preboot execution (PXE). All packages reviewed here execute local and LAN-based DMI querying except Compaq's Insight Manager, which queries using SNMP protocols. But only a few machines afford the six other functions.

DMI, a specification developed by a consortium called the Desktop Management Task Force, is essentially a software-based means of examining a machine's internal makeup. A machine is considered DMI 2.0-compliant if it is preloaded with certain low-level software agents (DMI service layer, component interface, and management interface). Any DMI 2.0-compliant package can query the machine and produce a

Does your desktop management package have a plug-in for major enterprise and server management suites?

	Inter Corp LANDesk Management Suite	Seagate Software Manage Exec	Novell Inc ManageWise	Hewlett Packard Co OpenView	Microsoft Corp Systems Management Server (SMS)	IBM Corp Tivoli TME 10	Computer Associates Inc Unicenter TN	Network Associates Inc Zero Administra- tion Client (ZAC)
Digital's ClientWorks					✓			
Compaq's Insight Manager	Partial*		✓	✓	✓	✓	✓	✓
IBM's LAN Client Control Manager 3.0†	✓			✓	✓	✓	✓	
Intel's LANDesk Client Manager	✓			✓		✓	✓	
Dell's OpenManage				✓		✓		
HP's TopTools				✓	✓		✓	

* LANDesk Client Manager and Configuration Manager only

† Comes with Intel's LANDesk Client Manager. With UMA (IBM's new Universal Management Agent). IBM's software can be customized to interact with all listed suites.

list of its major components, such as processor, memory, and BIOS.

The extent of this list varies among machines. If a vendor has done little more than install a DMI Service Layer—the basic, essential DMI agent—then you are limited to core components such as those mentioned above. If a vendor has done extensive work on DMI software agents, you can gather data on various peripherals, such as sound or SCSI cards, in addition to core components. LDCM 3.2 and 3.3 can even be programmed to recognize laptop-specific hardware such as PC Cards and docking stations.

At PC Magazine Labs, we loaded the administrator component of LDCM 3.1 on a our LAN server and remotely queried all 38 systems in our roundup. The server successfully read the DMI information on all the systems except the Compaq Deskpro EN Series, which Compaq says should come preloaded with a DMI agent even though it does not use a DMI software package. If you wish to use a third-party DMI administrator application with the Deskpro EN, make sure this agent is present.

Any DMI 2.0-compliant machine can also be queried with LDCM 3.2 or 3.3, Dell OpenManage, HP TopTools, or Secure Management Console (ClientWorks' remote component). The administrator component of LDCM 3.0 cannot access non-LDCM systems, however. Version 3.0 uses proprietary protocols rather than industry-standard Remote Procedure Calls (RPC). In addition to querying over a LAN, LDCM 3.2 and 3.3 can examine mobile systems via dial-up.

EXCEPTIONS

Unfortunately, most useful PC management exists outside the DMI specification. All five solutions covered here augment their system inventory capabilities with additional management features that may or may not use the existing DMI Service Layer infrastructure. With the exception of remote LAN wake-up, such features are available only with specified hardware. Compaq Insight Manager's temperature monitor, for instance, cannot be used on a Hewlett-Packard machine, HP TopTools' chassis intrusion alarm isn't available on a Dell PC, and so on.

Each solution offers some form of health monitoring. If a machine is properly equipped with an LM78 or LM79 ASIC—small chips from National Semiconductor—LDCM will launch alarms (to the local user or to a remote console) if the system's internal temperatures are too high, its internal voltages are irregular, or its fans fail.

OpenManage affords similar monitoring both locally and remotely, whereas ClientWorks does so only locally (to re-

ceive its remote alarms you must add a third-party SNMP package to the Secure Management Console). Though TopTools is capable of temperature and voltage monitoring, it can detect fan failures only on the Vecra VL reviewed here (the machine does not have an ASIC). Insight Manager reads hardware temperatures but cannot monitor voltages or fan speeds.

With SMART (Self-Monitoring Analysis and Reporting Technology) disks and ECC (Error Correcting Code) memory, all five packages can predict imminent hard disk and memory failures. Such support is available on new machines

from Compaq, Dell, Digital, and Hewlett-Packard but is used intermittently with LDCM machines. LDCM machines equipped with an SM (System Management) BIOS, formerly called a DM (Desktop Management) BIOS—can detect parity errors, boot failures, and boot viruses. The SM BIOS standard—defined by a consortium that includes Intel, Dell, and the major BIOS vendors—is also used by OpenManage.

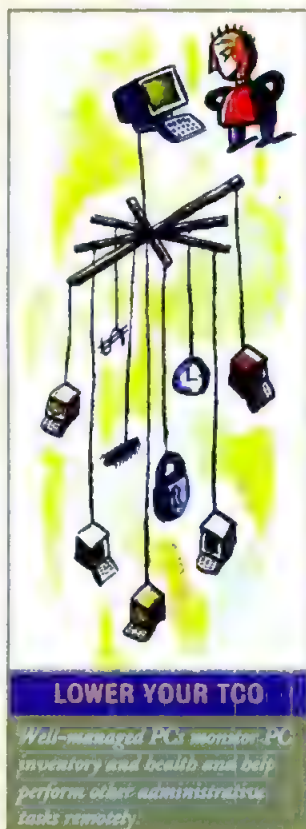
Chassis intrusion detection—supported by all five packages—requires a physical switch that recognizes when a system's cover has been removed. Again, this feature is available on the Compaq, Dell, Digital, and HP machines reviewed here but is limited in LDCM machines.

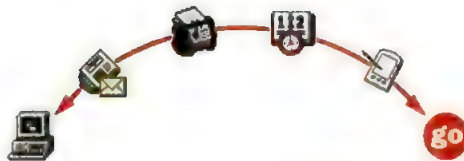
With the administrator components of OpenManage, TopTools, and LDCM, you can remotely power on any client machine that uses a remote LAN wake-up network adapter or similar hardware. Even when a system is turned off, a remote LAN wake-up adapter sits in a low-power state and polls the network for a particular wake-up packet. When the adapter receives the packet, it powers the machine on. Systems from Digital and Compaq include remote LAN wake-up adapters, but you'll need additional administration software such as Microsoft SMS

to execute a remote wake-up.

With TopTools and OpenManage and a free IBM utility known as LAN Client Control Manager, you can even update a system's BIOS or disable many of its components (floppy disk drive, keyboard, I/O ports, etc.) from a remote console. Compaq supports such features, but you'll need Microsoft SMS or another third-party software package to use them.

Finally, systems from Compaq, Dell, Digital, and Hewlett-Packard (and some LDCM machines) can handle preboot execution functions. With a PXE agent (typically part of the BIOS) and a third-party product such as Intel's LANDesk Configuration Manager, you can boot a machine even if it lacks a hard disk or an OS. The client goes out on the network to grab the OS from the server.—CM





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a guide to desktop management



By Anush Yeghazarian

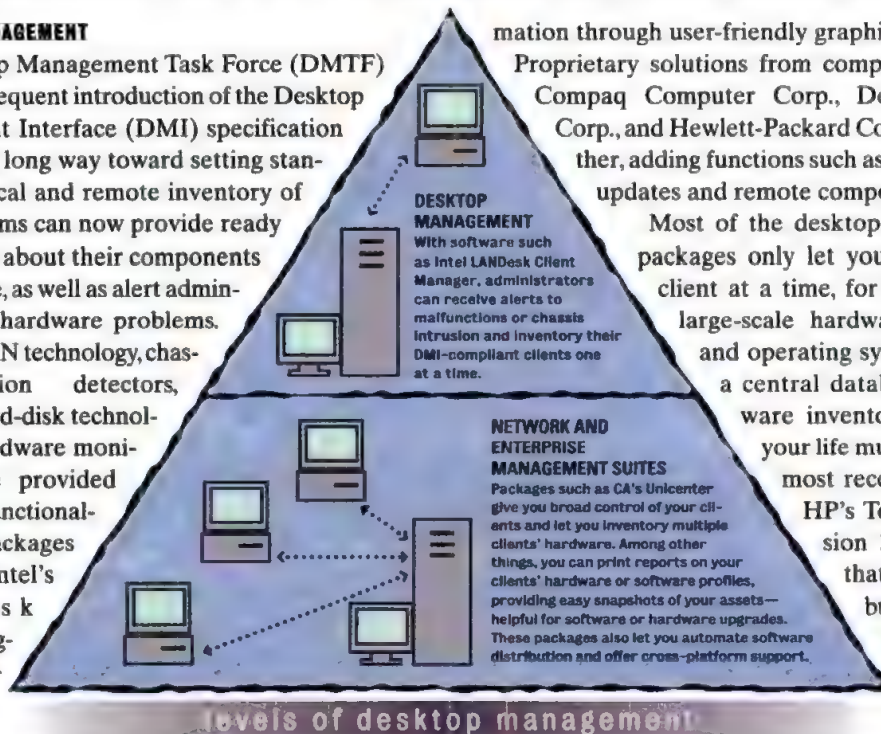
Recent attention to desktop and enterprise management has brought about welcome efforts toward greater standardization and simplification. The desktop management packages bundled with the PCs in this roundup are a good first step. But if you're already using a LAN or enterprise management suite (which have more robust management features) to manage your network, it makes sense to use the same package to manage your desktop. If you aren't using a management suite yet and you have a network with more than 100 clients, you should consider doing so.

DESKTOP MANAGEMENT

The Desktop Management Task Force (DMTF) and the subsequent introduction of the Desktop Management Interface (DMI) specification have gone a long way toward setting standards for local and remote inventory of assets. Systems can now provide ready information about their components and software, as well as alert administrators to hardware problems. Wake on LAN technology, chassis intrusion detectors, SMART hard-disk technology, and hardware monitoring have provided additional functionality. With packages such as Intel's LANDesk Client Manager, administrators access information

through user-friendly graphical interfaces. Proprietary solutions from companies such as Compaq Computer Corp., Dell Computer Corp., and Hewlett-Packard Co. go a step further, adding functions such as remote BIOS updates and remote component locking.

Most of the desktop management packages only let you look at one client at a time, for example. For large-scale hardware, software, and operating system updates, a central database of hardware inventory can make your life much easier. The most recent version of HP's Top Tools, Version 3.0, does add that functionality, but this management package is the exception, not the rule.



DMI features at a glance

We list the systems we reviewed in this issue as well as PCs from major manufacturers, detailing their management features. All of the systems we tested came with DMI BIOS and SMART hard disks.

Proprietary management	Telephone number	Web site	Management software	Fan monitoring	Voltage monitoring	Temperature monitoring	Chassis intrusion detector	Remote LAN wake-up	Remote power-on	Remote power-off	Remote BIOS update	Component branding
AcerPower Inveness 250	888-300-5545	www.abardeeninc.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
AcerPower 8000	800-733-2237	www.acer.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
ACMA N Power 333	800-796-6888	www.acma.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
ACT Brillianta PIII-350CM	800-775-1953	www.aliccomputer.com	Intel LDCM 3.04a	✓	✓	✓		✓	✓	✓		
American Multisystems InfoGold PII-NT	800-848-8815	www.infogold.com	Intel LDCM 3.1	✓	✓	✓	✓	✓	✓	✓		
Caliber Voyager Power Workstation	510-353-1220	www.calibercorp.com	Intel LDCM 3.1									
Compaq Deskpro EN Series	800-888-9328	www.compaq.com	Compaq Insight Manager		✓	✓	✓	✓	✓	✓	✓	✓
Comtrade Screamer Pro AGP 333	800-959-2123	www.comtrade.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
Dell OptiPlex GX1	800-999-3355	www.dell.com	Dell OpenManage	✓	✓	✓		✓	✓	✓	✓	✓
Digital PC5510 6333ST	800-344-4825	www.windows.digital.com	Digital ClientWorks 2.91	✓	✓	✓	✓	✓	✓	✓		
DTK AP10-76M/P333	800-289-2885	www.dtkcomputer.com	Intel LDCM 3.2	✓	✓	✓						
Everex StepStation 2 Model PII333	800-383-7391	www.everex.com	Intel LDCM 3.0	✓	✓	✓		✓	✓	✓		
Gateway E-series	800-845-2008	www.gateway.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓	✓	
Hertz P333e	888-222-7280	www.hertzttec.com	Intel LDCM 3.2		✓	✓		✓	✓	✓		
HP Vectra VL Series II	800-322-4772	www.hp.com/vectra	HP TopTools 2.8	✓		✓		✓	✓	✓	✓	✓
Hymco BTS-605	408-251-6888	www.hymco.com	Intel LDCM 3.1		✓	✓		✓	✓	✓		
IBM PC 330PL	800-426-2988	www.pc.ibm.com	IBM LCCM, Intel LDCM 3.1	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximus Graphics Artist Workstation	800-888-6294	www.maximusp.com	Intel LDCM 3.1		✓	✓						
Mega Computer Double Impact Pentium II/333+	800-336-8628	www.megacs.com	Intel LDCM 3.0	✓	✓	✓		✓	✓	✓		
Micro Express MicroFLEX-PII333	800-989-9900	www.microexpress.com	Intel LDCM 3.1	✓	✓	✓	✓	✓	✓	✓		
Micro ClientPro 800	888-634-8796	www.micropc.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓	✓	✓
Micro X MPD-8050	800-736-4276	www.microx.com	Intel LDCM 3.0	✓	✓			✓	✓	✓		
Monorail NPC 7230 NT	888-886-7245	www.monorail.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓	✓	
NEC PowerMate 8100	888-863-2669	www.nec-computers.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓	✓	
NexTrend NexStar-333	888-836-7827	www.nextrendpc.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
Polywell Poly 7333MD2	800-999-1278	www.polywell.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
Premie Shadowhawk LX 333	800-677-8427	www.premiopc.com	Intel LDCM 3.1	✓	✓	✓						
ProGen Venture Pro 350	800-843-1353	www.progen.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
Quasitex QPC/400 SE-3a	800-346-8865	www.quasitex.com	Intel LDCM 3.1		✓	✓		✓	✓	✓		
Reason Square 6-II SE/BX	800-800-4860	www.reasoncomputer.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
Royal Xpert SE-17	800-486-0008	www.goroyalpc.com	Intel LDCM 3.1		✓	✓		✓	✓	✓		
SAG STA 350	800-989-3475	www.sagelec.com	Intel LDCM 3.1		✓	✓		✓	✓	✓		
SIA PC-233-Pentium II Mid Tower	815-676-2224	www.siacomputer.com	Intel LDCM 3.2	✓	✓	✓	✓	✓	✓	✓		
Sys Performance Pro 400BA	800-613-9963	www.systechnology.com	Intel LDCM 3.04d	✓	✓			✓	✓	✓		
Tangent Medallion	888-829-4388	www.tangent.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		
TigerDirect Tiger Pro 333 NT	800-830-0056	www.tigerdirect.com	Intel LDCM 3.1			✓		✓	✓	✓		
Toshiba Equium 7180S	888-598-7962	computers.toshiba.com	Intel LDCM 3.1		✓	✓		✓	✓	✓		
Total Peripherals Serengeti 333+	800-923-7718	www.totalpc.com	Intel LDCM 3.1	✓	✓	✓						
Xi 333 NTower 2P	800-432-8486	www.xicomputer.com	Intel LDCM 3.0	✓	✓	✓		✓	✓	✓		
Zenon Platinum NLX4	800-893-6119	www.zenontech.com	Intel LDCM 3.1	✓	✓	✓		✓	✓	✓		

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4. Close the page and slip-sheet



Foldout slip-sheet



Inverted Foldout slip-sheet

Folded edge of the page

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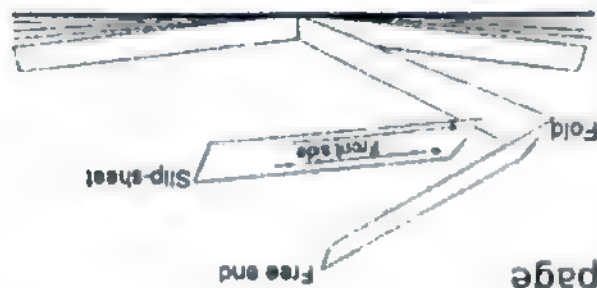
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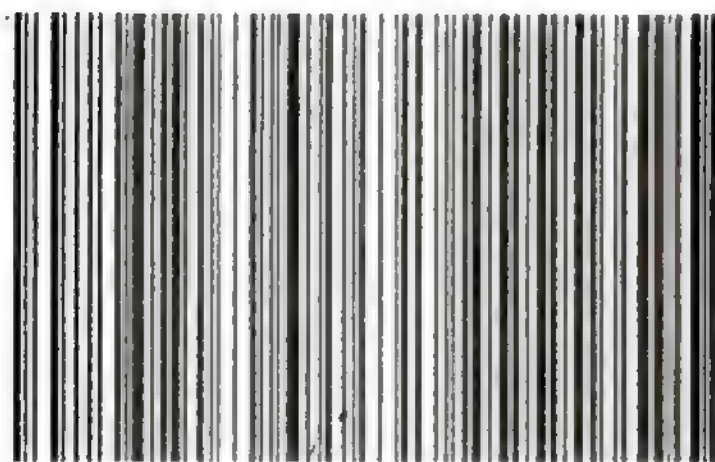
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

enterprise management software

Company	Product	General description	DMI 2.0	SNMP	Hardware fault reports	Software updates	Policy management	Inventory	Throughput monitoring
Computer Associates International Inc.	Unicenter TNG	TNG is a large extended family of capabilities for enterprise-wide management across many computers and operating systems. Only IBM's Tivoli TME 10 competes in scope. CA's Enterprise/Cai provides policy-based system configuration for desktops.	✓	✓	✓	✓	✓	✓	✓
Hewlett-Packard Co.	OpenView Desktop Administrator	A large and popular family of LAN/WAN and enterprise management products. Known primarily for SNMP management functions, but they also do software distribution and metering. TopTools DMI features included	✓	✓	✓	✓	✓	✓	✓
IBM Corp.	Tivoli TME 10	Provides enterprise-level software distribution, application monitoring, inventory, help desk service, user profiles, security, and task scheduling. Works on every platform. The TME 10 Inventory module collects DMI MIF information.	✓	✓	✓	✓	✓	✓	✓
Intel Corp.	LANDesk Management Suite	A good all-around LAN management product. Pushes software, provides an inventory, reports problems, squashes viruses, provides remote control, and analyzes traffic. Some hardware vendors offer customized versions of LANDesk Client Manager	✓		✓	✓	✓	✓	✓
Microsoft Corp.	Systems Management Server	The new big dog on the LAN management block. Main strengths: software distribution, inventory, and metering. Can read DMI MIF information. Microsoft has important desktop policy management enhancements in the works	✓		✓	✓	✓		
Network Associates Inc.	Net Tools Suites	Blend Helix, McAfee, Network General, and PGP and you have an aggressive and competent LAN desktop management company. Net Tools product suites include Sniffer Total Network Visibility and McAfee Total Service Desk (with Zero Administration Client).	✓	✓	✓	✓	✓	✓	✓
Novell Inc.	ManageWise	Novell's time-tested products know everything about the server and about network traffic. ManageWise gets its MIF smarts from LANDesk Client Manager and reaches beyond NetWare into Windows NT and Unix. Novell is adding more desktop policy management features.	✓		✓	✓		✓	✓
Platinum Technology Inc.	ProVision	An enterprise management system that monitors devices, databases, applications, and system utilization. ProVision gets its desktop configuration control, DMI MIF integration, and policy management from LANDesk.	✓	✓	✓	✓		✓	✓
Seagate Software	Desktop Management Suite	Product family includes WinLAND inventory software, which can read DMI MIF information. Related Seagate products—Manage Exec and Backup Exec—provide detailed server monitoring and control and centralized backup.	✓		✓	✓		✓	✓
Sun Microsystems	Solstice Enterprise Manager	One of the leading SNMP networkwide management systems. Best known as an SNMP management platform. Features include the ability to read the DMI MIF files and to use the MIF files as objects for SNMP reporting	✓	✓	✓			✓	✓
Symantec Corp.	Norton Administrator for Networks	A LAN-to-WAN product providing hardware and software inventory, software distribution, and software metering. Version 2.5 includes IP and DMI capabilities.	✓		✓				
Tally Systems Corp.	Cenergy Suite	A three-part package for inventory, software metering, and software distribution. The software reads the DMI MIF and also outputs usage data in MIF format for other applications. Specifically integrates with Microsoft SMS.	✓			✓		✓	

a dozen tips for bringing your PCs under control



By Frank J. Derfler, Jr.

1. It's very clear that the Desktop Management Interface is ready for prime time. Buy PCs and devices like LAN adapters equipped with DMI 2.0 reporting.
2. Ask vendors about specific management programs for their hardware products. Hewlett-Packard, Dell, Compaq, and other companies offer utilities with special reporting capabilities for their PCs.
3. Keep a log of the PC problems in your organization. If your organization has more than 100 employees and a permanent IS staff, consider installing help desk software. Use the support call information you gather to estimate the potential payback from centralized management.
4. If your log shows that the distribution and updating of software takes several hours of support time per week, then look at installing a back-end software distribution system.
5. If your log shows that users are creating their own problems by experimenting with system settings, then you can easily nail down the operating

system with the new features of Microsoft's Zero Administration Kit (ZAK) or Novell's Zero Effort Networking (Z.E.N.Works) as they become available later in 1998. Also see the review of Mical Development's Full Armor Zero Administration in our issue of May 5.

6. Software metering systems can save money in networks with more than half a dozen nodes. They track the number of licenses in use, prevent abuse, and allow you to buy less than the maximum number of licenses. Note that the agent software can prolong the boot process and that the metering steps require some end-user training. Some users resent the intrusion.
7. Hardware inventory systems help in troubleshooting and can control pilfering. They should be working in your computers if you find that you sometimes lose RAM or other computer pieces and parts. Some users resent the intrusion of the



inventory agent software.

8. Road warriors and people working from home can cost two to three times more to support than office workers, and they often lose their own productivity to computer problems. Practice using remote-control software to examine remote PCs and



9. build the skills needed to help distant users. Make program files, drivers, and recovery files available on a dial-up server for callers.
10. Prepare your users for tighter control. Let them know the benefits of centralized desktop management. Everyone resists changes. Tell them the reasons for change. Reduce their fears and doubts.
11. Windows terminals are valuable alternatives to standard PCs for people doing specific tasks. They don't impose a burden on your network, and they offer good economy.
12. Take advantage of the competitive server market to lease or buy high-reliability servers. Servers with built-in management are bargains.
13. Consider other thin client options such as Network Computers as substitutes for online terminals and as terminals for newly written Java applications. Consider handheld devices (our issue of March 10 has coverage) for special jobs.

LAN AND ENTERPRISE MANAGEMENT

LAN management packages such as Microsoft Systems Management Server add database and report functionality as well as tools to manage your server and monitor network traffic. Most packages also offer a mechanism for automated software distribution, and all now support DMI and SNMP.

Where they falter is in truly heterogeneous environments where you might have mainframes existing along with Unix workstations or both Apple and PC systems, as well as in cases where you have to manage a WAN, not only a LAN. At this level, you'll likely require a more robust, cross-platform solution, such as IBM Tivoli TME 10 and Computer Associates' Unicenter. Packages such

as these not only provide the cross-platform support you need but also have all the capabilities of the LAN packages and add help-desk and other services.

IN THIS GUIDE

In the following pages, check "Enterprise Management Software," where we describe the most popular LAN and enterprise management packages, with some discussion of features and specifications they support. "DMI At a Glance" is a table of contact information and a comparison of the management features provided by the systems we reviewed in this issue, as well as additional vendors' machines that weren't ready in time for the review.

YOU'RE

NOT A MINDLESS

FOOL

A SNAPPY HEADLINE.

Micron[®] Millennia Desktops

Millennia 233	Millennia 333	Millennia 350	Millennia 400	Millennia 400 Plus
• 233MHz Intel Pentium[®] II processor • 32MB SDRAM • 4.0GB Ultra ATA hard drive • 15" Micron 500FGx, .28dp monitor (13.7" display) • 82440LX chip set • 512KB internal cache, 2MB flash BIOS • 3.5" floppy drive • 32X EIDE variable speed CD-ROM drive • 128-bit AGP Diamond Viper V330 (nVidia), 4MB EDO SGRAM & MPEG • Integrated 32-voice Wavetable 3D stereo sound • Advent AV009 stereo speakers • 56K x2 data/fax modem* • 104-key enhanced keyboard • Microsoft[®] IntelliMouse[™] • Microsoft Windows[®] 95 and Microsoft Plus! • Microsoft Office 97 Small Business Edition • 5-year/3-year Micron Power[™] limited warranty	• 333MHz Intel Pentium II processor • 32MB SDRAM • 4.0GB Ultra ATA hard drive • 17" Micron 700FGx, .26dp monitor (16" display) • 82440LX chip set • 512KB internal cache, 2MB flash BIOS • 3.5" floppy drive • 32X EIDE variable speed CD-ROM drive • 128-bit AGP Diamond Viper V330 (nVidia), 4MB EDO SGRAM & MPEG • Integrated 32-voice Wavetable 3D stereo sound • Advent AV009 stereo speakers • 56K x2 data/fax modem* • 104-key enhanced keyboard • Microsoft IntelliMouse • Microsoft Windows 95 and Microsoft Plus! • Microsoft Office 97 Small Business Edition • 5-year/3-year Micron Power limited warranty	• 350MHz Intel Pentium II processor • 32MB PC100 SDRAM • 4.0GB Ultra ATA hard drive • 17" Micron 700 FGx, .26dp monitor (16" display) • 82440BX chip set • 512KB internal cache, 2MB flash BIOS • 3.5" floppy drive • 32X EIDE variable speed CD-ROM drive • 128-bit AGP Diamond Viper V330 (nVidia), 4MB EDO SGRAM & MPEG • Integrated 64-voice Wavetable 3D stereo sound • Advent AV009 stereo speakers • 56K x2 data/fax modem* • 104-key enhanced keyboard • Microsoft IntelliMouse • Microsoft Windows 95 and Microsoft Plus! • Microsoft Office 97 Small Business Edition • 5-year/3-year Micron Power limited warranty	• 400MHz Intel Pentium II processor • 32MB PC100 SDRAM • 4.0GB Ultra ATA hard drive • 17" Micron 700 FGx, .26dp monitor (16" display) • 82440BX chip set • 512KB internal cache, 2MB flash BIOS • 3.5" floppy drive • 32X EIDE variable speed CD-ROM drive • 128-bit AGP Diamond Viper V330 (nVidia), 4MB EDO SGRAM & MPEG • Integrated 64-voice Wavetable 3D stereo sound • Advent AV009 stereo speakers • 56K x2 data/fax modem* • 104-key enhanced keyboard • Microsoft IntelliMouse • Microsoft Windows 95 and Microsoft Plus! • Microsoft Office 97 Small Business Edition • 5-year/3-year Micron Power limited warranty	• 400MHz Intel Pentium II processor • 64MB PC100 SDRAM • 8.4GB Ultra ATA hard drive • 17" Micron 700 FGx, .26dp monitor (16" display) • 82440BX chip set • 512KB internal cache, 2MB flash BIOS • Integrated 100MB Iomega Zip drive/3.5" floppy drive • DVD-ROM drive and PCI decoder card • 128-bit AGP Diamond Viper V330 (nVidia), 4MB EDO SGRAM & MPEG • Integrated 64-voice Wavetable 3D stereo sound • Advent AV009 stereo speakers • 56K x2 data/fax modem* • 104-key enhanced keyboard • Microsoft IntelliMouse • Microsoft Windows 95 and Microsoft Plus! • Microsoft Office 97 Small Business Edition • 5-year/3-year Micron Power limited warranty
\$1,599 Bus. Lease \$56/mo	\$2,099 Bus. Lease \$73/mo	\$2,299 Bus. Lease \$80/mo	\$2,499 Bus. Lease \$87/mo	\$2,945 Bus. Lease \$101/mo

TransPort[®] Trek[™] Portables

Common Features on all TransPort Systems:

- 512KB L2 pipeline burst cache
- PCI bus with 128-bit graphics accelerator
- USB, parallel, serial, VGA, PS/2, ports
- S-Video Out; MPEG compatible
- CardBus and Zoomed Video ready
- Wavetable/3D Positional sound
- Microphone, stereo line in/out jacks
- 2 Type II or 1 Type III PCMCIA slots
- 20X modular CD-ROM drive
- 2-way infrared port
- Touchpad pointing device
- Modular floppy drive
- Li-Ion battery
- Microsoft Windows 95 and Microsoft Plus!
- 5-year/1-year Micron limited warranty
- Norton Anti-Virus
- System Wizard Mobile Client[™]

Trek 233	Trek 333	Trek 266
• 233MHz Intel Pentium processor with MMX[™] technology • 32MB EDO RAM • 2.1GB hard drive • 12.1" SVGA TFT display	• 233MHz Intel Pentium processor with MMX technology • 32MB EDO RAM • 2.1GB hard drive • 13.3" XGA TFT display • Microsoft Office Small Business Edition • Choice of Portable Software Solutions Pak	• 266MHz Intel Pentium processor with MMX technology • 32MB EDO RAM • 3.2GB hard drive • 13.3" XGA TFT display • Microsoft Office Small Business Edition • Choice of Portable Software Solutions Pak
\$1,999 Bus. Lease \$70/mo	\$2,499 Bus. Lease \$87/mo	\$2,699 Bus. Lease \$92/mo

GoBook[™] Portables

Common Features on All GoBook Systems:

- 4.4 lbs (w/floppy)
- 6.7 lbs (w/opt./base battery & floppy)
- 512K L2 pipeline burst cache
- 12.1" SVGA display
- PCI bus with 128-bit graphics
- USB, parallel, serial, VGA, PS/2, NTSC/S-Video, ports
- S-Video Out; MPEG compatible
- CardBus/Zoomed Video ready
- 16 bit stereo/Wavetable sound
- Microphone, stereo line in/out jacks
- 24X modular CD-ROM drive
- 2 Type II or 1 Type III PCMCIA slots
- 2-way infrared port
- Touchpad pointing device
- Modular floppy drive
- Norton Anti-Virus
- Microsoft Windows 95 and Microsoft Plus!
- 5-year/1-year Micron limited warranty
- System Wizard Mobile Client[™]

GoBook 233	GoBook 333	GoBook 266
• 233MHz Intel Pentium processor with MMX technology • 32MB EDO RAM • 2.1GB hard drive • Super Base battery • Bay battery • Microsoft Office Small Business Edition • Choice of Portable Software Solutions Pak	• 233MHz Intel Pentium processor with MMX technology • 32MB EDO RAM • 2.1GB hard drive • Super Base battery • Bay battery • Microsoft Office Small Business Edition • Choice of Portable Software Solutions Pak	• 266MHz Intel Pentium processor with MMX technology • 32MB EDO RAM • 2.1GB hard drive • Super Base battery • Bay battery • Microsoft Office Small Business Edition • Choice of Portable Software Solutions Pak
\$2,599 Bus. Lease \$89/mo	\$2,999 Bus. Lease \$102/mo	\$3,299 Bus. Lease \$113/mo

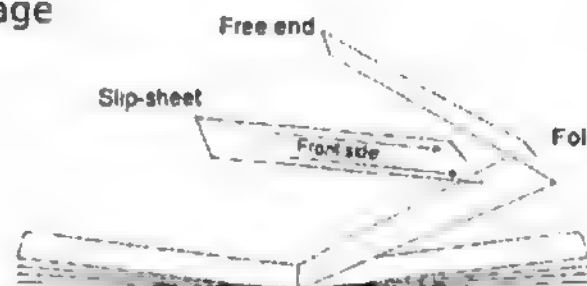


MICRON POWER WARRANTY

1. 5-year limited warranty on Micron desktop and main memory.
2. 3-year limited warranty on Micron portable and main memory.
3. 1-year limited warranty on Micron portable and main memory.
4. 1-year limited warranty on Micron portable and main memory.
5. 1-year limited warranty on Micron portable and main memory.
6. 1-year limited warranty on Micron portable and main memory.
7. 1-year limited warranty on Micron portable and main memory.
8. 1-year limited warranty on Micron portable and main memory.
9. 1-year limited warranty on Micron portable and main memory.
10. 1-year limited warranty on Micron portable and main memory.

TO ORDER CALL TOLL-FREE 800-776-4512 OR ONLINE AT www.micronpc.com

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Foldout slip-sheet



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Inverted Foldout slip-sheet

Folded edge of the page

1. Open the foldout page

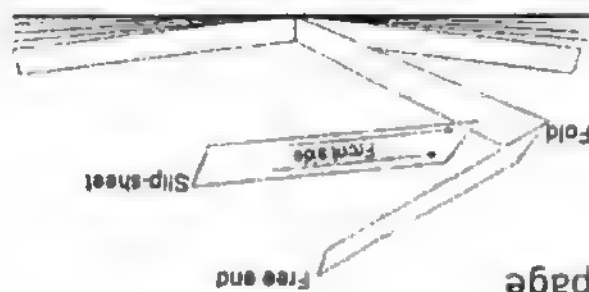
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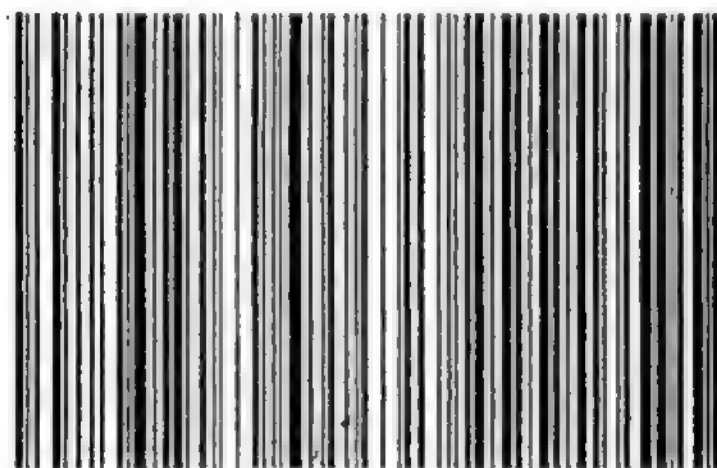
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4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



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Back

1. Follow instructions on the other side

THAT'S WHY THIS ISN'T



We don't build our systems for people who are easily impressed by flashy marketing. We build them for the people who do their homework. Those who

know the industry, read the reviews, and are willing to make decisions based

**"POWER USERS WILL LOVE THE NEW
MICRON MILLENNIA" - PC MAGAZINE**

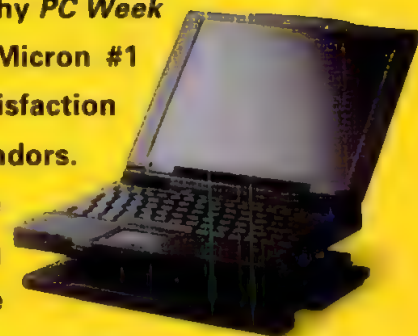
on who makes the best product at the right price.

No cute mascot. No artsy photography. No clever tag line. We simply use the finest components to build a better product and sell those systems directly to the customer for less money.



Perhaps that's why *PC Week* readers ranked Micron #1 in customer satisfaction among all PC vendors.

Next time you're shopping around, compare Micron's price and performance to any in the industry. After all, once you buy your system and plug it in, all of the hype and all of the clever marketing gimmicks that may have swayed your decision no longer matter. What you need



**"PROVIDING REMARKABLY HIGH PERFORMANCE AND
SOME WONDERFUL VERSATILITY, THE MICRON TRANSPORT
266 IS OUR EDITOR'S CHOICE WINNER" - PC MAGAZINE**

is a box that works and stays working, superior tech support, and a price below what you expect to pay. And that's exactly what we offer.



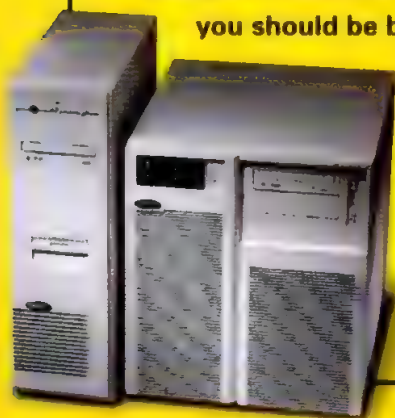
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CLEVER HEADLINES MEAN NOTHING

Take away the catchy headline. Forget the cute bovine mascot. Ignore the jingle that sticks in your head and look at the product. Look at how it's built, what it costs and how it's supported. That's what really matters, and since 1985 that's all we've focused on. Perhaps that's why Micron was just ranked first among all PC vendors in customer satisfaction by *PC Week* readers. We invite you to compare the numbers for yourself because a better server is the only thing you should be buying.



"These new servers position Micron as a premiere full-line, build-to-order server supplier for corporations"

NetFRAME® 3100

- 350MHz Intel Pentium® II processor
- 4GB Ultra-Wide SCSI-3 Hard drive
- 64MB ECC 100MHz SDRAM
- Microsoft® Windows NT® Server 4.0 (10 user license)
- NOS Support (3 incident resolutions/1st year), 7x24
- Intel 440BX PCI chip set
- 512KB integrated L2 ECC cache
- 100MHz front side Bus
- 3.5" floppy drive
- Integrated Symbios PCI Ultra Wide SCSI-3 dual channel controller
- 5 expansion slots: 3 PCI, 1 ISA
- 1 shared PCI/ISA
- 8 drive bays: 1 external 3.5", 2 external 5.25"
- 5 hot swap 1.0" hard drive bays
- 32X EIDE CD-ROM drive
- Integrated SVGA graphics (2MB)
- Integrated Intel 10/100 Ethernet
- 104-key Enhanced PS/2 keyboard
- Microsoft mouse with Mouse Manager
- Intel LANDesk® Server Manager
- Dedicated server technical support, 7x24
- 5-year/3-year Micron Power™ limited warranty
- 1-year next-business-day on-site service**

\$4,299

Bus. Lease \$136/mo

NetFRAME MV5000

- 233MHz Intel Pentium II processor
- Dual Pentium II processor capable
- 512KB integrated L2 ECC cache
- 64MB ECC SDRAM
- 4GB Ultra Wide SCSI-3 hard drive
- Microsoft Windows NT Server 4.0 (10-user-license)
- NOS support (3 first-year incident resolutions), 7x24
- 9 expansion slots: 6 PCI, 2 ISA, 1 shared ISA/PCI
- Dual integrated Symbios Ultra Wide SCSI-3 controller
- Integrated Symbios narrow SCSI controller
- Intel EtherExpress™ Pro 100 network adapter
- 32X EIDE CD-ROM drive
- Embedded RAID upgrade option
- I/O-ready via embedded Intel i960-RD
- 5 internal, hot-pluggable, hard drive array bays (upgradable to 10)
- One 360-watt hot-pluggable power supply standard (upgradable to 3 for added redundancy)
- Rack adapter option
- Intel LANDesk Server Manager 2.8
- Dedicated server technical support, 7x24
- 5-year/3-year Micron Power limited warranty
- 1-year next-business-day on-site service**

\$4,599

Bus. Lease \$146/mo



"Micron's dual-processor...server runs full steam ahead."

-PC Computing



Feb '98



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before they've even been booted.

At the high end are HP OpenView, CA Unicenter, IBM's Tivoli TME 10 NetView, and other post-boot enterprise management solutions, which can manage multiple network environments as well as individual clients running multiple operating systems. These packages control the greatest enterprise management market share, yet in some cases offer little low-level detailed asset tracking of each machine. For most large corporate environments, pairing an enterprise manager with one of the DMI solutions reviewed here is the ideal.

As said, HP TopTools natively integrates with OpenView, CA Unicenter, and SMS. Similarly, Intel's recently introduced LDCM administrator plug-ins integrate with OpenView, Unicenter, and Tivoli NetView. So-called Intel Application Integration Modules (AIMs) can be coded for any other enterprise management solution using Intel's Console Integration Guide. The guide and all extant plug-ins are available free from the company's Web site. Insight Manager and OpenManage are not available as plug-ins per se, but data from each can easily be read using Microsoft SMS.

WORTHY OF NOTE

One of the leading bundled desktop management solutions was not ready in time for our roundup. IBM's newest addition to its 300 series, the IBM PC 300PL, surrounds LDCM 3.3 with a host of supplementary management applications. And it's available with a Pentium II/400 and AGP graphics.

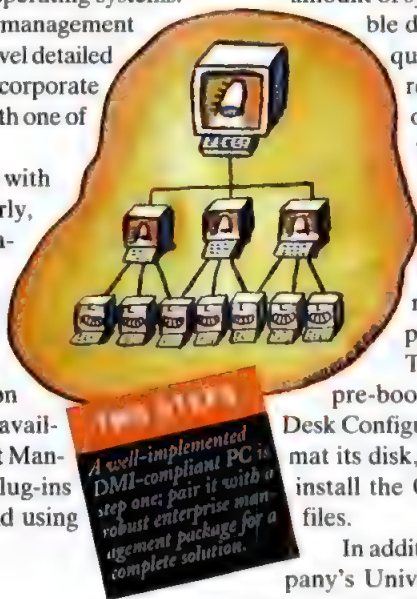
This is the first system to use Alert on LAN, a technology new to LANdesk Client Manager. Previously, LDCM launched alarms only when a system's chassis was opened, its voltages were out of specifications, or its internal temperatures were too high. When joined by the Intel 82558 Fast Ethernet controller and an Alert on LAN ASIC (as it is on the 300PL), LDCM 3.3 alerts administrators when someone unplugs a machine's power source, disconnects its network connection, removes its processor, or disables its OS. The feature is active even when the machine is powered down. Alert on LAN will soon be available with systems from Acer and Gateway as well.

IBM also bundles three proprietary solutions: Asset ID, SMART Reaction, and LanClient Control Manager (LCCM) 2.0. Each PC 300PL is equipped with an EEPROM that stores the serial numbers of all internal components, CPU speed, amount of system memory, and other user-programmable data. Using a hand-held Asset ID radio-frequency unit (sold by third parties), you can read to and write from the EEPROM without opening the system, making it easy to inventory system assets.

The system's SMART Reaction software not only anticipates SMART hard disk failures but automatically backs up your data before failures occur. With added programming, the software will even send e-mail or pager notifications to IT administrators.

Though free of charge, LCCM is similar to pre-boot management applications such as LAN-Desk Configuration Manager. LCCM can wake a PC, format its disk, flash its BIOS, change its CMOS settings, install the OS and application images, and run batch files.

In addition, the PC 300PL is equipped with the company's Universal Management Agent (UMA), a low-level piece of code through which Microsoft SMS, LANdesk Management Suite, Tivoli, OpenView, and CA Unicenter can seamlessly read the machine's DMI-based data. This allows LCCM, an adept but incomplete package, to work in tandem with a prevailing post-boot manager. According to IBM, UMAs can be used with third-party systems as well.



SOLUTIONS

Clearly, desktop management is not as simple as DMI Service Layers and chassis intrusion alarms. You can't maintain a sprawling corporate network with only LDCM or OpenManage. In fact, ClientWorks is designed primarily as a local application, not a remote manager. Compaq claims that more than 35 percent of its new customers use Insight Manager, but the other major vendors estimate a much lower usage of their bundled packages. Alone, a low-level DMI solution just isn't enough. Choose a manageable machine, then manage it with third-party server applications.

Vendor Service and Reliability

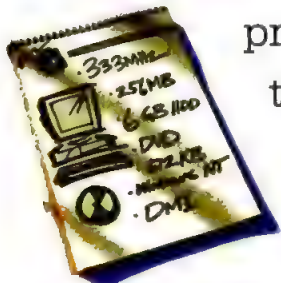
We rate vendors for which we received at least 50 responses on our latest Service and Reliability Survey of 17,000 subscribers. These results reflect readers' experiences with desktop PCs from a given vendor. We analyzed the data using a t-test, a standard statistical procedure for identifying differences from the average that are significant at the 95 percent confidence level. For details, see our July 1997 issue. The **satisfaction** rankings reflect respondents' experiences with **reliability**, **repair**, and **tech support** over the past two years. **Percent of units needing repair** refers to the proportion of desktops that respondents said needed repair during the past year. Here, "significantly better than average" means that the incidence of needed repairs was lower than average.

	Satisfaction with			Percent of units needing repair over past 12 months
	Reliability	Repair	Tech support	
▲ Significantly better than average ○ Average ▼ Significantly worse than average				
Acer	○	○	▼	○
Compaq	▲	○	▲	▲
Dell	▲	▲	▲	▲
Digital	▲	○	▲	○
DTK	○	○	○	▼
Everex	▼	○	○	○
Hewlett-Packard	▲	▲	▲	○
Micron	▲	▲	▲	○
NEC	○	○	○	○
Quantex	▲	▲	▲	▼
Toshiba	▲	○	○	○

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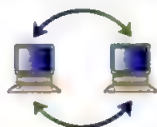
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TOSHIBA

BENCHMARK TESTS

Managed PCs



A fast CPU is a start: You need a well-tuned PC with fast components, such as a 7,200-rpm disk, to elevate performance.

What the Numbers Mean

Winstone 98 Well-tuned, fast subsystems make for the best all-around system performance. The Sys Performance Pro 400BA was our top performer on both the **High-End** and **Business Winstone 98** test suites. The Sys unit combined a fast CPU, cache, and memory subsystem and top 2-D graphics acceleration from the reliable Matrox Millennium II card to come in first. Interestingly, the Sys machine did not include a 7,200-rpm hard disk, as did the next three finishers, from Micron, NEC, and Hewlett-Packard; the Sys PC used a 5,400-rpm IBM Ultra ATA-3 disk. The higher rotational speed of a 7,200-rpm disk would have only enhanced its performance.

With a score that would have been average for a Pentium II/400, the ProGen Venture Pro 350 came in first among the Pentium II/350 systems on Business and High-End Winstone tests. It used a Maxtor Ultra ATA-3 hard disk and a Matrox Millennium II graphics card.

The Royal Xpert SE-17 was unable to run the Winstone tests, likely because of graphics driver problems. We tried looking for assistance at the company's Web site and asked the vendor to offer us assistance as well. We received a new test system and new drivers, but unfortunately Royal was unable to resolve the problem; no results are reported.

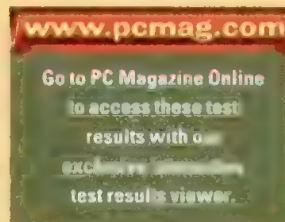
We have seen anywhere from no difference to as much as 15 percent deterioration in performance from 24-bit to 32-bit color depth. In both cases, only 8 bits of R, G, and B (red, green, and blue) data are used to represent color, totaling 24 bits of color information, or roughly 16.7 million possible colors. A 32-bit color setting has R, G, B, and A data, where A is the alpha channel that is not used by today's 2-D applications, and essentially is wasted space. Vendors such as ATI and Matrox take advantage of that last byte position in their 24-bit solutions and stuff data from the following

pixel, so their sequences look like R-G-B-R, followed by G-B-R-G, then B-R-G-B, and so on. Solutions like these effectively send 32 bits of true pixel data across the 32-bit PCI (or AGP) bus without wasting a byte position (as the 32-bit solutions do). This improves PCI utilization.

Graphics WinMark 98 The Matrox Millennium II AGP and the Number Nine Revolution 3D were our top-performing 2-D accelerators, as measured by ZD High-End Graphics WinMark 98 and ZD Business Graphics WinMark 98. Both the 400-MHz Sys Performance Pro 400BA and the 333-MHz Mega Double Impact Pentium II/333+ used the Matrox card. The 350-MHz SAG STA 350 used the

Number Nine card. The Diamond Fire GL 1000 Pro card based on the 3DLabs Permedia 2 chip gave the Comtrade Screamer Pro AGP 333 the edge to come in first on the High-End Graphics WinMark tests among the 333-MHz systems.

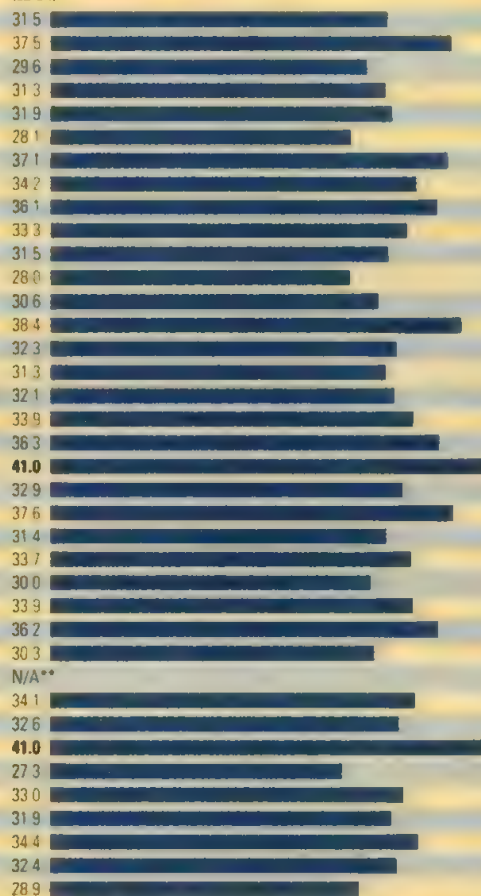
All the systems used either Windows RAM (WRAM) or Synchronous Graphics RAM (SGRAM). WRAM, dual-ported like VRAM, features a number of enhancements specifically geared toward improving graphics performance in any GUI environment. Unlike DRAM, WRAM has a color write-block mode that should enhance screen redraw performance and a memory design that should facilitate better text rendering.



High scores are best
Bold type denotes first place

Aberdeen Inverness 350 (PII/350)	31.5
Acer AcerPower 8000 (PII/400)	37.5
ACMA N Power 333 (PII/333)	29.6
ACT Brilliantia P6II-350CM (PII/350)	31.3
American Multisystems InfoGold (PII/333)	31.9
Caliber Voyager Power Workstation (PII/333)	28.1
Compaq Deskpro EN Series (PII/400)	37.1
Comtrade Screamer Pro AGP 333 (PII/333)	34.2
Dell OptiPlex GX1 (PII/400)	36.1
Digital PC5510 6333ST (PII/333)	33.3
DTK APRI-76M/P333 (PII/333)	31.5
Everex StepStation 2 (PII/333)	28.0
Hertz P333e (PII/333)	30.6
HP Vectra VL Series 8 (PII/400)	38.4
Hymco BTS-605 (PII/333)	32.3
Maximus Graphics Artist Workstation (PII/350)	31.3
Mega Double Impact PentiumII/333+ System (PII/333)	32.1
Micro Express MicroFlex-PII/333 (PII/333)	33.9
Micro X MPD-8050 (PII/400)	36.3
Micron ClientPro 400 (PII/400)	41.0
Monorail NPC 7230 NT (PII/333)	32.9
NEC PowerMate 8100 (PII/400)	37.6
NexTrend NexStar-333 (PII/333)	31.4
Polywell Poly 7333MD2 (PII/333)	33.7
Premio Shadowhawk LX 333 (PII/333)	30.0
ProGen Venture Pro 350 (PII/350)	33.9
Quantex QP6/400 SB-3x (PII/400)	36.2
Reason Square 6-II SE/BX (PII/333)	30.3
Royal Xpert SE-17 (PII/350)	N/A**
SAG STA 350 (PII/350)	34.1
SIA P6/333-Pentium II Mid Tower (PII/333)	32.6
Sys Performance Pro 400BA (PII/400)	41.0
Tangent Medallion (PII/333)	27.3
Tiger Pro 333 NT (PII/333)	33.0
Toshiba Equium 7100S (PII/350)	31.9
Total Serengeti 333+ (PII/333)	34.4
Xi 333 MTower SP (PII/333)	32.4
Zenon Platinum NLX4 (PII/333)	28.9

ZD High-End Winstone 98
(32 bit)



N/A*—Not applicable. The product does not support the tested color depth. N/A**—Not applicable. The product did not complete this test.

SGRAM is a type of single-ported DRAM. It can open two memory pages at once to help increase throughput. It also employs masked writes and block writes to increase bandwidth for graphics-intensive functions. The performance difference between the two types of RAM is minimal, but SGRAM has become more popular because it is less expensive.

We also got our first look at the new Matrox graphics chip, the MGA-G100, used in the the DTK APRI-76M/P333 and the HP Vectra VL Series 8. The MGA-G100, an average performer, is aimed at price-sensitive business users who need top 2-D performance as well as 3-D acceleration.

Except for four systems, all graphics accelerators were run on AGP. The Hertz P333e, Reason Square 6-II SE/BX, Tiger Pro 333 NT, and Total Serengeti 333+ all used PCI-based solutions. Although the use of PCI cards had a minimal effect on those systems' Graphics WinMark scores, it does leave you with a system that isn't using

all of today's technology. AGP is designed to help performance in the increasing 3-D market where games rule (3-D business applications are just starting to appear). However, AGP occasionally has problems under Windows NT.

Both the Reason Square 6-II SE/BX and the Royal Xpert SE-17 failed to run our Graphics WinMark tests (the former only under 32-bit), again because of graphics driver problems. Like Royal, Reason Computer submitted new drivers for its PC, but that did not resolve the problem.

Again, we report both 32-bit and 24-bit results. Here, the difference in performance was more striking: We saw differences of 10 to 50 percent between 24-bit and 32-bit results.

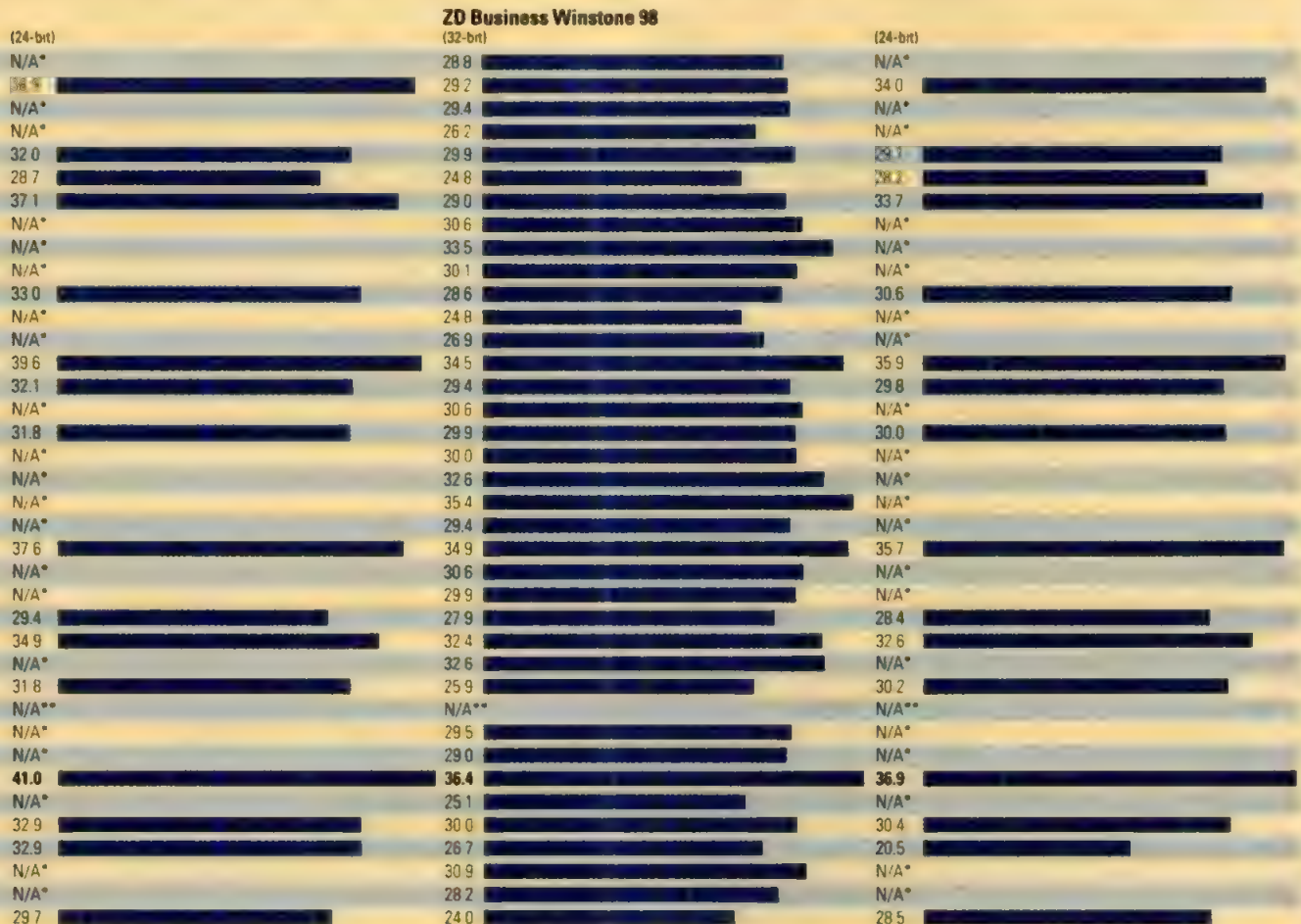
Disk WinMark 98 Two factors made for the best-performing systems on our ZD High-End and Business Disk WinMark 98 tests: 7,200-rpm disks and FAT16 partitions. With new IDE-based disks moving

up to the 7,200-rpm speed level where SCSI disks have been for years, performance has made a big jump. Compared with 5,200- and 5,400-rpm disks, the 7,200-rpm disks give you a 28 to 36 percent performance boost on the Business Disk WinMark tests. Disks formatted using FAT16 partitions also gave a performance boost, albeit only 2 to 3 percent.

The new IBM Deskstar DTTA-371010 disk used in the HP Vectra VL Series 8, the Micron ClientPro 400, and the NEC PowerMate 8100 proved to be the fastest disk on the block. The Deskstar, a 7,200-rpm disk, boasts a 33.3-MBps maximum transfer rate, a 9.5-ms seek-to-read time, and a 512K buffer.

Since all the disks in this roundup support Ultra DMA, which offers a maximum burst throughput of 33.3 MBps, this was not a factor in performance.

CPUmark₃₂ Intel has taken much of the processor subsystem optimization out of





IBM.

DO STRANGERS WATCH

MHz denotes microprocessor internal clock speed only; other factors may also affect application performance. ¹GB=1 billion bytes when referring to hard drive capacity; accessible capacity may be less. ²5 pounds is travel weight including battery and HDD. With additional CD-ROM drive or floppy drive, weight is about 5.5 pounds. Actual weight may vary. ³May vary due to componentry and variances. ⁴Model 31U. Estimated authorized IBM Reseller Price. Actual prices may vary. PCs referenced in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Intel Inside and Pentium are registered trademarks and MMX is a trademark of Intel Corporation. ©1998 IBM Corp. All rights reserved.



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BENCHMARK TESTS

system vendors' hands. With the processor module containing the processor, L1, and L2 caches and the 440BX chip set containing the memory controller, there is little left for a vendor to do. Even so, our ZD CPUmark₃₂ tests showed a variance of 6 to 9 percent within processor groups. With so much else taken care of, we believe the last place left to optimize is the memory leadoff and burst cycle timings. These timings can typically be set by the manufacturer in the BIOS and can have a minimal effect on CPU/memory performance.

The Intel 440BX is the industry's first AGP chip set to support a 100-MHz bus on a Slot 1 motherboard. The 100-MHz speed is the timing from the memory to chip set. This boosts performance in memory-

intensive applications as well as in AGP graphics applications that store texture maps in main memory. For most common applications, though, the end user will see little or no gain from the 100-MHz memory bus alone. In addition to the 100-MHz bus, the 440BX chip set adds quad-port acceleration (QPA). Intel's QPA optimizes memory accesses and bus arbitration. Intel claims that QPA will provide better performance for 3-D graphics applications.

Interestingly, the Reason Computer Square 6-II SE/BX came with a 440BX chip set. The chip set detects the type of processor and adjusts the CPU and bus clock speed so that the system is running at 333 MHz on a 66-MHz memory bus. Since the unit was mostly an average performer,

the 440BX chip set provided no apparent performance boost.

CD-ROM and Multimedia Tests This roundup included a predominance of 32X CD-ROM drives. Although the variable speed of these drives means that they perform slower than the 32X suggests, they did lead on our CD-ROM and Multimedia tests. For pure video horsepower with no quality considerations, look at the Maximum Frame Rate scores. Systems with video cards based on the ATI Rage Pro performed best.—*Analysis written by Rich Fisco*

How We Tested

We tested our corporate PCs running Microsoft Windows NT Workstation 4.0

▲ High scores are best. Bold type denotes first place.	ZD High-End Graphics WinMark 98		ZD High-End Disk WinMark 98	ZD Business Graphics WinMark 98		ZD Business Disk WinMark 98	ZD CPUmark ₃₂ ▲
	32-bit ▲	24-bit ▲	Thousands of bytes per second ▲	32-bit ▲	24-bit ▲	Thousands of bytes per second ▲	
Aberdeen Inverness 350 (PII/350)	167	N/A*	3,570	141	N/A*	1,320	865
Acer AcerPower 8000 (PII/400)	166	194	4,530	84	145	1,910	1,000
ACMA N Power 333 (PII/333)	156	N/A*	3,560	117	N/A*	1,620	830
ACT Brillianta P6II-350CM (PII/350)	123	N/A*	3,610	71	N/A*	1,740	800
American Multisystems InfoGold (PII/333)	138	158	3,370	135	131	1,580	832
Caliber Voyager Power Workstation (PII/333)	154	178	2,870	89	151	1,090	823
Compaq Deskpro EN Series (PII/400)	166	194	4,230	84	146	1,690	997
Comtrade Screamer Pro AGP 333 (PII/333)	179	N/A*	4,210	143	N/A*	1,660	861
Dell OptiPlex GX1 (PII/400)	146	N/A*	4,100	146	N/A*	1,660	994
Digital PC5510 6333ST (PII/333)	153	N/A*	4,500	126	N/A*	1,840	827
DTK APRI-76M/P333 (PII/333)	151	171	3,970	109	159	1,670	836
Everex StepStation 2 (PII/333)	122	N/A*	3,250	78	N/A*	1,250	848
Hertz P333e (PII/333)	145	N/A*	3,200	110	N/A*	1,400	828
HP Vectra VL Series 8 (PII/400)	184	195	5,690	146	160	2,480	992
Hymco BTS-605 (PII/333)	165	170	3,470	130	145	1,610	831
Maximus Graphics Artist Workstation (PII/350)	189	N/A*	3,430	156	N/A*	1,530	873
Mega Double Impact PentiumII/333+	168	170	4,050	147	156	1,450	828
Micro Express MicroFlex-PII/333 (PII/333)	168	N/A*	4,130	142	N/A*	1,750	835
Micro X MPD-8050 (PII/400)	176	N/A*	4,290	139	N/A*	1,640	998
Micron ClientPro 400 (PII/400)	190	N/A*	5,320	154	N/A*	2,480	1,020
Monorail NPC 7230 NT (PII/333)	168	N/A*	3,840	127	N/A*	1,490	807
NEC PowerMate 8100 (PII/400)	199	205	4,190	150	172	2,190	1,020
NexTrend NexStar-333 (PII/333)	158	N/A*	4,330	135	N/A*	1,890	833
Polywell Poly 7333MD2 (PII/333)	155	N/A*	3,910	136	N/A*	1,790	830
Premio Shadowhawk LX 333 (PII/333)	161	163	2,750	129	143	1,300	825
ProGen Venture Pro 350 (PII/350)	181	190	3,860	153	182	1,590	878
Quantax QP6/400 SB-3x (PII/400)	190	N/A*	3,430	152	N/A*	1,620	1,030
Reason Square 6-II SE/BX (PII/333)	N/A**	173	3,390	N/A**	147	1,740	825
Royal Xpert SE-17 (PII/350)	N/A**	N/A**	4,170	N/A**	N/A**	1,490	914
SAG STA 350 (PII/350)	189	N/A*	4,950	158	N/A*	1,980	857
SIA P6/333-Pentium II Mid Tower (PII/333)	159	N/A*	3,690	134	N/A*	1,660	808
Sys Performance Pro 400BA (PII/400)	222	228	4,950	202	214	1,950	1,070
Tangent Medallion (PII/333)	133	N/A*	2,990	80	N/A*	1,350	832
Tiger Pro 333 NT (PII/333)	164	167	4,200	146	156	1,490	828
Toshiba Equium 7100S (PII/350)	153	182	3,250	81	147	1,600	872
Total Serengeti 333+ (PII/333)	157	N/A*	4,320	132	N/A*	1,780	834
Xi 333 MTower SP (PII/333)	157	N/A*	3,730	106	N/A*	1,790	829
Zenon Platinum NLX4 (PII/333)	130	158	3,220	70	132	1,400	815

N/A*—Not applicable. The product does not support the tested color depth. N/A**—Not applicable. The product did not complete this test.

with 64MB of RAM. Each system had a 4GB hard disk or larger. After verifying that each system had Service Pack 3 installed, we installed the TCP/IP stack required by High-End Winstone 98, then ran our tests using the vendor's formatting for each drive (either NTFS or FAT16) and using the graphics driver the vendor provided.

ZD Winstone 98 is divided into two parts: **ZD High-End Winstone 98**, which emphasizes CPU- and graphics-intensive applications, and **ZD Business Winstone 98**, which focuses on mainstream applications. Our High-End Winstone 98 tests measure the time a PC takes to execute a set of application scripts that exercise seven Windows NT applications. High-

End Winstone 98 weights a given machine's seven timings equally, derives a composite number, and converts that to a relative score. (The score is relative to the performance of a Dell Dimension Pentium/133 with 32MB of RAM, at 1,024-by-768 resolution with 16-bit color, running Windows NT 4.0 with Service Pack 3. The base score is defined as 10.)

Business Winstone 98 measures the time a PC takes to execute a set of scripts that exercise nine of the best-selling Windows 95 applications. Business Winstone 98 weights a PC's test timings based on the applications' unit market shares; it derives a composite number and converts that to a relative score. (The score is relative to the performance of the base machine above,

with the same base score of 10.)

ZD WinBench 98 measures a system's graphics, disk, processor, and CD-ROM performance under Windows 95. Like our Winstone test program, **ZD Graphics WinMark 98** and **ZD Disk WinMark 98** are each divided into high-end and business sections.

The **ZD High-End Graphics WinMark 98** and **ZD Business Graphics WinMark 98** scores are based on a log of GDI operations used in the High-End and Business Winstone 98 tests, respectively. Both scores are normalized to reflect performance relative to the base system used for Winstone testing.

The **ZD High-End Disk WinMark 98** and **ZD Business Disk WinMark 98** scores are based on a log of disk functions used in the High-End and Business Winstone suites, respectively. We record the results in thousands of bytes per second and convert them to a harmonic mean. We then weight this mean in the same way as the Winstone 98 and Business Winstone 98 scores, respectively.

The **ZD CPUmark₃₂** score reflects the speed of a PC's processor subsystem, which includes the CPU, primary and secondary cache, and system RAM, under 32-bit operating systems. CPUmark₃₂ emulates the CPU activity of real-world 32-bit applications.

The **ZD CD-ROM WinMark 98** tests gauge the performance of each machine's CD-ROM subsystem, which includes the CD-ROM drive, adapter, and required software drivers. The tests are based on a profile of today's most popular Windows CD-ROMs. We also report the results of the **CD-ROM Transfer Rate: Inside** test, which measures the throughput of a CD-ROM subsystem reading the inside track of the CD-ROM—the minimal level of performance for the drive. The **CD-ROM Access Time** test measures performance as the drive randomly accesses 2K blocks from the entire CD-ROM. The **CD-ROM CPU Utilization** test measures the percent of the CPU's bandwidth occupied by servicing the CD-ROM subsystem as it retrieves data.

WinBench 98 also includes a suite of video tests that measure a PC's ability to play full-motion AVI files. These tests run a video clip with four different codecs: Cinepak, Indeo 3.2, Indeo 4.x, and MPEG. We tested using MPEG only, through ActiveMovie control. We report results from the **Full-Screen Scaling** test, which uses an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip; specifically, we report **Maximum Frame Rate** and **CPU Utilization**.

	CD-ROM			Full-Screen Scaling ¹		
▲ High scores are best. ▼ Low scores are best. Bold type denotes first place.	ZD CD-ROM WinMark 98 ▲	Transfer Rate: Inside (thou- sands of bytes per second) ▲▼	Access Time (milliseconds) ▼	CPU Utilization (percent) ▼	Maximum Frame Rate (frames per second) ▲	CPU Utilization (percent) ▼
Aberdeen Inverness 350 (PII/350)	2,020	2,460	81	4	49.7	63
Acer AcerPower 8000 (PII/400)	1,930	3,030	102	3	104.0	30
ACMA N Power 333 (PII/333)	2,000	2,430	88	66	50.4	62
ACT Brillianta P6II-350CM (PII/350)	1,860	2,430	87	76	68.8	45
American Multisystems InfoGold (PII/333)	1,940	2,430	86	69	68.4	46
Caliber Voyager Power Workstation (PII/333)	1,920	2,430	88	67	30.8	95
Compaq Deskpro EN Series (PII/400)	1,230	1,940	111	69	72.3	42
Comtrade Screamer Pro AGP 333 (PII/333)	1,710	2,170	98	4	69.7	44
Dell OptiPlex GX1 (PII/400)	2,000	2,590	80	3	104.0	30
Digital PC5510 6333ST (PII/333)	2,000	2,420	85	5	63.7	49
DTK APRI-76M/P333 (PII/333)	1,840	2,430	88	4	71.8	47
Everex StepStation 2 (PII/333)	1,860	2,440	86	70	36.3	83
Hertz P333e (PII/333)	1,970	2,410	86	4	76.2	42
HP Vectra VL Series 8 (PII/400)	1,890	2,500	83	3	69.4	45
Hymco BTS-605 (PII/333)	1,730	2,170	97	59	68.7	45
Maximus Graphics Artist Workstation (PII/350)	1,900	2,430	88	73	61.0	51
Mega Double Impact PentiumII/333+	1,950	2,410	87	5	55.3	56
Micro Express MicroFlex-PII/333 (PII/333)	1,200	1,630	131	66	53.2	58
Micro X MPD-8050 (PII/400)	1,920	2,430	89	3	56.0	54
Micron ClientPro 400 (PII/400)	2,100	2,650	79	8	71.5	44
Monorail NPC 7230 NT (PII/333)	2,030	2,600	90	5	65.1	48
NEC PowerMate 8100 (PII/400)	1,950	2,520	81	73	82.9	36
NexTrend NexStar-333 (PII/333)	1,090	1,130	103	2	55.8	55
Polywell Poly 7333MD2 (PII/333)	1,840	2,440	89	67	40.5	75
Premio Shadowhawk LX 333 (PII/333)	1,510	1,230	104	64	62.8	49
ProGen Venture Pro 350 (PII/350)	2,040	2,450	77	3	64.5	48
Quantex QP6/400 SB-3x (PII/400)	1,920	2,430	87	71	60.2	52
Reason Square 6-II SE/BX (PII/333)	1,830	2,450	90	82	55.8	67
Royal Xpert SE-17 (PII/350)	2,050	N/A**	N/A**	N/A**	N/A**	N/A**
SAG STA 350 (PII/350)	1,880	2,440	87	4	47.6	45
SIA P6/333-Pentium II Mid Tower (PII/333)	1,890	2,420	88	68	50.1	62
Sys Performance Pro 400BA (PII/400)	1,610	2,170	100	99	51.0	62
Tangent Medallion (PII/333)	1,910	2,440	83	71	47.6	64
Tiger Pro 333 NT (PII/333)	1,470	2,040	112	4	55.1	56
Toshiba Equium 7100S (PII/350)	1,760	2,160	93	65	72.9	42
Total Serengeti 333+ (PII/333)	1,940	2,450	85	4	55.6	55
Xi 333 MTower SP (PII/333)	1,920	2,590	92	70	48.8	62
Zenon Platinum NLX4 (PII/333)	1,590	2,160	99	95	58.2	53

(1) With an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip. N/A**—Not applicable. The product did not complete this test.

Aberdeen Inverness 350

Pentium II/350, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 31.5. \$2,495 direct.

Aberdeen targets corporate executives, stressing custom configurations. While the Inverness 350 comes with a Zip Drive and a fair number of management features, Aberdeen's California-biased service and support make this system appealing mostly for West Coast businesses. This midpriced unit is an average performer overall with below-average disk scores.

The system came with Intel LANDesk Client Manager 3.1. The unit has hardware monitoring of chassis temperature, fan speed, and CPU voltage.

Access is relatively easy: You just pop off the front cover, loosen three screws, and swing out the side panel. There is no padlock bracket. All inside components are readily accessible, and there is adequate expansion room.

Most of the Inverness 350's scores were average for its CPU class, but its Disk WinMark 98 score was quite low. The unit has a relatively slow 5,400-rpm Seagate hard disk that uses NTFS partitions, which slightly hinder performance as compared with FAT partitions.

Service and support terms for the Inverness 350 are best for California corporate customers. Aberdeen's one-year warranty (with technical support during weekday business hours, Pacific time) can be enhanced with four years of on-site coverage for \$199.95, but this option is available only in California.

The Inverness 350 offers some manageability features and solid performance. If your business is on the West Coast, it may be an attractive choice.

—Bruce Brown

Aberdeen LLC, Santa Fe Springs, CA; 888-300-5545, 562-699-6998; fax, 562-695-5570; www.aberdeeninc.com. Choose 511 at www.pcmag.com/infolink.

Acer AcerPower 8000

Pentium II/400, 6.4GB hard disk, 17-inch monitor, 64MB SDRAM. High-End Winstone score: 37.5. \$2,790 street.

The AcerPower 8000 offers good nationwide service and support and a reasonable management package.

The DMI 2.0-compliant and ACPI-ready unit comes with the operating system loaded, but other bundled software, including Intel's LANDesk Client Manager 3.1, McAfee Anti-Virus, and Lotus Organizer 97GS, are not loaded. Acer's software installer guides you through the software loading to help you configure the software for your enterprise's specific needs. The machine

does not have a chassis intrusion alarm, but it does have hardware monitoring of temperature, fan, and voltage, as well as support for Wake on LAN through its Intel Ethernet card.

The tool-free case is very sturdy, with extra cross-bracing, but the structure makes accessing memory slots a little awkward. There is an exterior padlock bracket.

The AcerPower 8000 has average performance for its class. That speaks well for the unit's overall design, particularly since the on-board 4MB ATI Rage Pro chip attained below-average test scores on our Graphics WinMark tests.

The standard support package includes a three-year warranty, with 24-hour live technical support. On-site support is standard for the first year, \$59 for two years, and \$99 for three years—a good deal. The parts replacement turnaround policy is 24 hours but isn't guaranteed.

Solid performance from a fast platform plus some good management features make the AcerPower a reasonable choice for corporate settings.—BB

Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; fax, 800-554-2494; www.acer.com. Choose 512 at www.pcmag.com/infolink.

ACMA N Power 333

Pentium II/333, 4.3 GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 29.6. \$1,995 direct.

The ACMA N Power 333 offers a solid management solution at an appealing price.

The unit is intended for government and corporate environments in which MIS wants more control

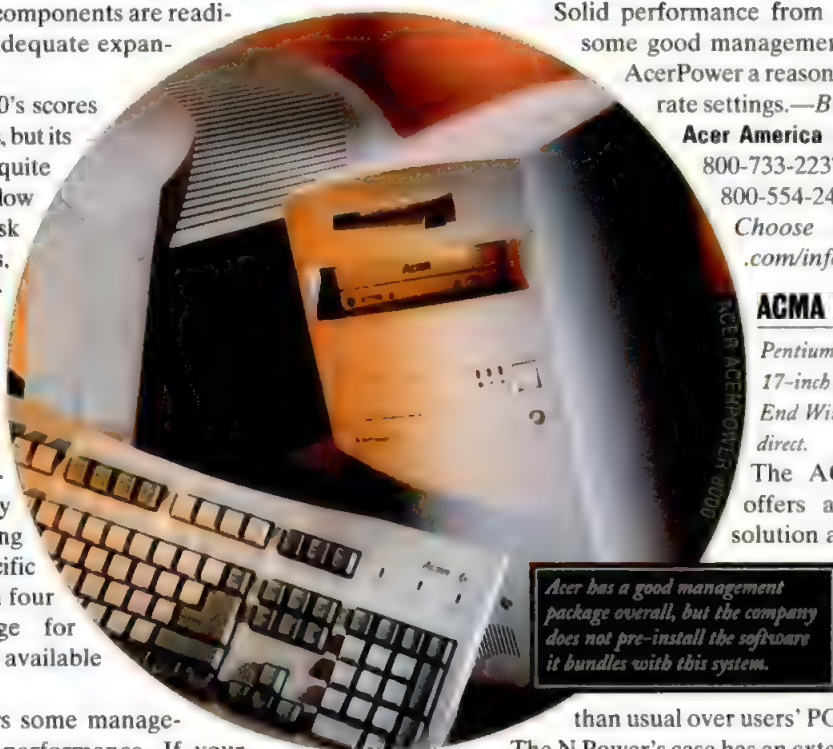
than usual over users' PCs.

The N Power's case has an external padlock bracket, but the unit comes with no chassis intrusion detector. Using Intel's LANDesk Client Manager and National Semiconductors' LM78 ASIC, the unit monitors system temperature, fan speed, and voltage levels. An integrated 10/100-Mbps Ethernet adapter supports Wake on LAN.

The N Power has an NLX motherboard and a spacious interior design that allows good access for memory and card upgrades given its small case size. One drive bay is empty, though it's not very accessible.

Based on the Intel 440LX chip set, the N Power achieved midrange scores across most of our benchmark tests compared with the other 333-MHz Pentium II systems. Thanks to its 32X Toshiba CD-ROM drive, it earned one of the top scores in this roundup on our CD-ROM WinMark test.

The warranty includes one year of on-site coverage and three years on parts, with toll-free technical support during business hours (Pacific time) on weekdays. On-site labor coverage for two



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extra years via Dow Jones costs \$99. Remote diagnostic service is expected in the third quarter of this year.

This ACMA system is an appealing low-cost managed PC.
—BB

ACMA Computers Inc., Fremont, CA; 800-786-6888, 510-623-1212; fax, 510-623-0818; www.acma.com. Choose 513 at www.pcmag.com/infolink.

ACT Brillianta P6II-350CM

Pentium II/350, 6.4GB hard disk, 17-inch monitor, 64MB SDRAM. High-End Winstone score: 31.3. \$2,498 direct.

All Computer Technology positions the Brillianta P6II-350CM for corporate, government, and educational institutions. The unit offers average manageability and support and mostly average performance.

The Brillianta came with Intel's LANdesk Client Manager 3.04e installed. It offers hardware monitoring of temperature, fan, and voltage through the LM78 ASIC but lacks a chassis intrusion alarm. The unit supports Wake on LAN through its Intel EtherExpress Pro/100 network card. Remote power-on is also supported.

The case requires removal of a few screws, and you'll need to remove one or more expansion cards to add memory. Drive access is also a bit difficult, though there is room for expansion. The case is lockable.

A 4MB Trident AGP-9800 graphics adapter contributed to some of the lowest Business and High-End Graphics WinMark 98 scores in this roundup. The GigaByte motherboard and Intel 440BX chip set contributed to the fastest CPUmark₃₂ score among 350-MHz systems, however. Other scores were average.

Standard support includes a one-year warranty and technical support during business hours Pacific time. A \$179.95 four-year warranty upgrade includes on-site service and 24-hour live technical support. Under that program, service response is within 48 hours, with a three-day parts turnaround. The system comes with Microsoft Office 97 Small Business Edition.

The Brillianta offers average manageability and mostly average performance for its CPU class at a moderate price.—BB

All Computer Technology, City of Industry, CA; 800-775-1953, 626-369-4181; fax, 626-961-7462; www.allcomputer.com. Choose 514 at www.pcmag.com/infolink.

American Multisystems InfoGold

Pentium II/333, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 32. \$2,250 direct.

The InfoGold PII-NT offers some manageability features and provides rich graphics support. American Multisystems markets

the unit as a professional-series system for presentation or entry-level CAD use.

The motherboard comes with an LM78 ASIC that together with Intel's LANdesk Client Manager 3.1, enables the system to monitor fan speed, temperature, and voltage levels. The unit's 3Com Ethernet card supports Remote Wake-up (equivalent to Wake on LAN).

The ATX motherboard can easily slide out of the stout, lockable mid-tower case. But upgrading memory could be difficult if you don't want to remove the motherboard: The DIMM slots are blocked by the power supply and cables. All of the tested unit's ISA slots were filled.

The Diamond Viper AGP graphics card yielded solid performance, and the unit comes with TV video-out support, as well as a quality Creative Labs AWE64 sound card and Yamaha speakers. On the plus side, a 56-Kbps modem is included; the 4.3GB hard disk, however, is smaller than most in this roundup.

American Multisystems provides a one-year warranty with one year of on-site service. Live technical support is available weekdays during business hours (Pacific time). Technical support is also available via the company's Web site, which includes links to hardware manufacturers; updated

drivers, however, are not listed directly.

The InfoGold offers basic management features, average performance, and TV video-out support, but you may find better bargains elsewhere.—Frank J. Evans

American Multisystems, Milpitas, CA; 800-888-6615, 408-945-2296; fax, 408-945-2299; www.infogold.com. Choose 515 at www.pcmag.com/infolink.

Caliber Voyager Power

Pentium II/333, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 28.1. \$1,760 street.

Caliber Computer Corp.'s Voyager Power Workstation is a general-purpose managed PC positioned as a value system for corporate and government offices. The 333-MHz Caliber system has very limited system manageability and below-average performance for its CPU class, but its low price may make it attractive to some.

While the system is bundled with Intel's LANdesk Client Manager and is DMI 2.0 compliant, it lacks such manageability features as hardware monitoring and a chassis intrusion alarm, as well as support for Wake on LAN.

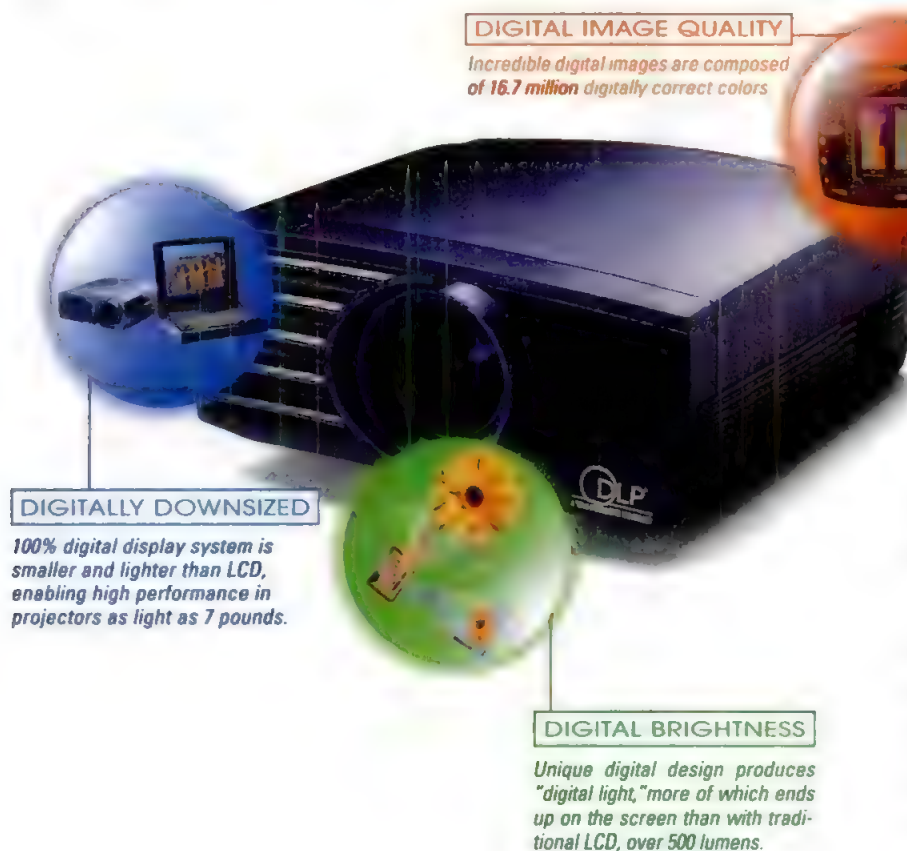
The Caliber system comes in a typical mid-tower case with an ATX motherboard. There is more than typical expansion capacity, with four free PCI slots and five available drive bays on the



The ACT PC offers the basic monitoring features in a standard (though not tool-free) mid-tower case.

DLP VS. LCD: A DIGITAL DIFFERENCE YOU CAN SEE AND FEEL.

By S. E. Easter



DIGITAL IMAGE QUALITY

Incredible digital images are composed of 16.7 million digitally correct colors

DIGITALLY DOWNSIZED

100% digital display system is smaller and lighter than LCD, enabling high performance in projectors as light as 7 pounds.

DIGITAL BRIGHTNESS

Unique digital design produces "digital light," more of which ends up on the screen than with traditional LCD, over 500 lumens.

DLP technology has pioneered a new class of extremely bright ultraportables. A projector weighing under 10 pounds can now deliver over 600 lumens of digital light.

system. DLP technology is able to achieve higher levels of brightness through its all-digital design, producing more usable light than traditional LCD systems for brilliant, lifelike displays.

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For more information on DLP technology or for a complete list of manufacturers using DLP technology, call us toll-free or visit us on the Web.



Digital Light Processing™ (DLP™) technology from

Texas Instruments is a revolutionary all-digital technology that enables lighter and smaller projectors. Unlike conventional LCD systems that contain large,

heavy optics, DLP technology allows a smaller, more compact optical system that delivers phenomenal visual impact.

Brightness is a critical performance factor in any projector and an important function of the DLP optical

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www.ti.com/dlp/it

tested system. All components are accessible.

The Voyager's ABit motherboard with Intel 440LX chip set helped the unit achieve an average CPU score for its class, but all other scores were below average.

Caliber offers a standard one-year labor, two-year parts warranty along with weekday business hours technical support (Pacific time). Extended warranties with on-site coverage and vendor-paid shipping of replacement parts both ways are available by arrangement.

Low cost is the only redeeming feature of the tested Caliber unit. For better system manageability and performance, you should either upgrade this configuration or look elsewhere.—BB
Caliber Computer Corp., Fremont, CA; 510-353-1220; fax, 510-354-2134; www.calibercorp.com. Choose 516 at www.pcmag.com/infolink.

Compaq Deskpro EN Model 6400

Pentium II/400, 6.4GB hard disk, 17-inch monitor, SDRAM. High-end Winstone score: 37.1. \$3,330 street.

Compaq's DeskPro EN series offers the highest level of manageability among the company's desktop PC lines. The Deskpro EN Model 6400 is the series' current flagship, with great system serviceability, advanced manageability features, and top service and support. Compaq also markets the EP PC series, targeted toward users seeking maximum performance and value.

The EN unit's desktop case is extremely easy to service. Its components tilt out for easy removal and replacement, and its motherboard features a simple release via a single lever in the middle of the system—all without tools. The system's Smart Cover Lock and case sensor detects and records intrusions while other hardware monitors temperature. Other models offer fan and voltage monitoring as well.

Each system component has a trackable asset number that is recorded by Compaq's Insight Manager—an SNMP-based solution that has a DMI extension. Insight Manager can send an alert of an impending hard disk failure and notify the system administrator if system memory has been changed. The bundled Intel Ethernet card supports remote LAN wake-up. Insight Manager also allows remote BIOS updates and remote locking of such components as the hard and floppy disk drives and the case.

The ATI 3D Rage Pro card held the unit to a low graphics score for its class, which in turn affected the unit's Business Winstone score. Performance is adequate overall, however.

Compaq's standard warranty, backed by 24-hour toll-free technical support, covers parts for three years and labor on-site for one year. Under warranty Compaq pays for replacement

parts shipping both ways and is one of the few companies that offers remote diagnostic service.

The Compaq DeskPro EN series has a somewhat higher initial cost than many of the other tested PCs, but the ease of service, high level of intelligent system manageability, and top-level service and support policies make this line a standard by which others should be measured.—BB

Compaq Computer Corp., Houston, TX; 800-888-0220, 281-370-0670; fax, 281-518-1442; www.compaq.com.

Comtrade Screamer Pro AGP 333

Pentium II/333, 8.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 34.5. \$2,180 street.

The Comtrade Screamer Pro AGP 333 is marketed toward both end users and corporations that want networked systems with a good balance of price and performance. The system delivers the average management features and the performance value it promises. The only question is Comtrade's relatively limited one-year warranty.

Intel's LANDesk Client Manager 3.1, which comes installed, enables the system to monitor temperature, fan operation, and voltage levels; the unit, however, has no chassis intrusion alert. Wake on LAN is supported through the Intel EtherExpress Pro/100B card.

The Screamer Pro's case has an external padlock bracket; otherwise the unit is a typical tower (not tool-free), offering good access to expansion slots but somewhat awkward access to memory slots.

Strong Winstone 98 test scores prove that the Screamer

Pro's GigaByte motherboard, Intel 440LX chip set, IBM hard disk, and

Diamond Fire GL

1000 Pro graphics adapter board work well together. The unit also achieved top CPU marks; scores

on the remaining tests were solidly average for 333-MHz systems.

On-site service is a \$25 option for the year. Technical support is available from 7:00 to 7:00 Pacific time weekdays, 8:00 to 5:00 Saturdays.

A fair price and top performance scores recommend the unit, and it offers good management capabilities. The Screamer Pro is held back only by a short warranty.—BB

Comtrade Computer Inc., City of Industry, CA; 800-969-2123, 626-961-6688; fax, 626-369-1479; www.comtrade.com. Choose 518 at www.pcmag.com/infolink.

Dell OptiPlex GX1

Pentium II/400, 4.3GB hard disk, 17-inch monitor, 64MB SDRAM. High-End Winstone score: 36.1. \$2,803 direct.



Compaq's complete management package includes remote locking of components and tracked component asset numbers.

The Dell OptiPlex GX1 is an update of the already proficient GXa model. It uses the same modular chassis as the GXa but benefits from several hardware enhancements and an updated management software package (formerly Dell Inspector, recently renamed Dell OpenManage).

In addition to providing standard DMI 2.0 inventory features, Dell OpenManage can remotely flash the GX1's BIOS and disable various hardware components (neither feature is available with Intel LANDesk alone). OpenManage can also remotely wake the machine, monitor motherboard temperatures, and recognize chassis intrusions. (For more information, see the sidebar "The State of Desktop Management" in this feature.)

Dell's managed PC mini-tower chassis is among the most tractable on the market. When you pull a lockable release in the rear of the machine, a side panel gently pops off to reveal the interior hardware. You can remove the bus-slot cage (offering three PCI, two shared, and two ISA slots) with the pull of a lever, and the power supply and an internal drive bay cage (two 3.5-inch bays) swing out on hinges.

With the GX1, Dell offers remote LAN wake-up support and a SMARTII hard disk; the Intel 440BX chip set, 350- and 400-MHz Pentium IIs, SCSI storage, and 8MB of graphics memory are all options. Fully loaded—save for the SCSI hard disk—the tested GX1 was a fair performer for its CPU class. All results were average except for disk scores: Most other drives in this category spin at 5,400 to 7,200 rpm, but the Dell's 4.3GB Maxtor unit, spinning at 5,200 rpm, kept the unit's score below average.

Dell will continue to offer the GXa, but the GX1 may be too affordable to pass up. Well equipped and offering a capable DMI solution, it competes with any managed PC on the market.—*Cade Metz*

Dell Computer Corp., Round Rock, TX; 800-999-3355, 512-338-4400; fax, 512-728-3653; www.dell.com. Choose 519 at www.pcmag.com/infolink.

Digital PC 5510 6333ST

Pentium II/333, 6.4GB hard disk, 15.7-inch monitor, SDRAM. High-End Winstone score: 33.4. \$2,989 direct.

At press time, Digital had yet to announce a 350- or 400-MHz version of its high-end corporate machine, but the PC 5510 is an admirable, if expensive, 333-MHz option. The successor to Digital's PC 5500 offers an unusual but generally beneficial chassis design and a recently enhanced version of ClientWorks, the company's proprietary DMI software.

The interior of the tower case can be accessed by undoing

three rear thumbscrews and removing a lockable side panel. A bus-slot board with three open connectors sits below a shelf holding the small motherboard, power supply, and several drive bays. The motherboard slides out through the top of the chassis on rails, but you must first remove the Diamond AGP board and a tiny audio port board.

To this fairly manageable chassis, Digital adds ClientWorks (see sidebar). ClientWorks 2.91 displays DMI data in a classic MIF browser interface, monitors temperatures and voltages, recognizes chassis intrusions, and automatically adjusts fan speeds. If overheating occurs, the package launches local alarms and can send alerts to a remote station via SNMP. An application called SecureONconsole, also included, affords DMI browsing and remote LAN wake-up from a remote console.

In its processor class, the 5510 was an above-average performer on Disk WinMark and CD-ROM WinMark tests; it had average scores on our other tests.

Such slight performance benefits, however, cannot fully justify the 5510's price. Of

Digital has added remote thermal alerts to its ClientWorks-based managed solution, a feature missing from previous versions.

course, the extra dollars do provide a removable motherboard and a good DMI package. Digital also offers 24-hour technical support and a three-year warranty with one year of on-site service.—*CM*

Digital Equipment Corp., Maynard, MA; 800-344-4825, 508-467-5111; fax, 508-480-8583; www.windows.digital.com. Choose 520 at www.pcmag.com/infolink.

DTK APRI-76M/P333

Pentium II/333, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 31.5. \$2,000 street.

Intended for the general corporate market, DTK Computer's APRI-76M/P333 is a good value. With a moderate level of system manageability and strong average benchmark test scores, the DTK system could be a good choice.

The DTK unit's conventional case with ATX motherboard offers good access to memory, expansion card slots, and drive bays. The case cannot be locked, however, and has no chassis intrusion alarm. The motherboard allows monitoring of CPU temperature, fan operation, and voltage levels. The unit came with an Intel EtherExpress Pro/100B network interface card and Intel's LANDesk Client Manager, Version 3.2, installed. The network card we received had no Wake on LAN support, but it is available at no extra cost.

The Intel 440LX chip set on a motherboard of DTK's own design proved a strong performance base for this system, which posted average scores for its CPU class on all tests.

DTK also supplies a Windows 95 multimedia keyboard with calculator and special function keys. The APRI-76M/P333 has a two-year warranty, with technical support available weekdays during business hours in all U.S. time zones. On-site support coverage is available for \$50 per year per client site. DTK offers a 24-hour guaranteed response and a 48-hour parts replacement guarantee.

If system purchase cost is a driving factor and you don't need comprehensive manageability, the APRI-76M/P333 is a fine choice.—BB

DTK Computer Inc., City of Industry, CA; 800-289-2385, 626-810-0098; fax, 626-810-0090; www.dtkcomputer.com. Choose 521 at www.pcmag.com/infolink.

Everex StepStation 2

Pentium II/333, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 28.0. \$2,180 street.

Everex Systems' StepStation 2 Model PII333 offers manageability at a level above that of many systems in this roundup, along with slightly above-average service and support policies. The unit is intended for corporate users needing high-end graphics or working with AutoCAD, though its test results indicate you'll need a better graphics card for serious work.

The StepStation 2 features no chassis intrusion detection. Our test unit had Intel's LANDesk Client Manager 3.0 (3.1 is currently available) installed to monitor temperature, fan operation, and voltage levels. Equipped with an Intel EtherExpress Pro/100B board, the StepStation 2 supports Wake on LAN. The unit's big tower case, though not tool-free, affords easy access to all components and offers plenty of expansion room.

The test machine's Yuan 300S AGP graphics card, which had 4MB of SGRAM and an nVidia RIVA 128 AGP graphics chip set, led to a low Graphics WinMark 98 test score. Its Seagate ST 36451A 6.4GB hard disk contributed to a below-average disk score, and the combination resulted in a relatively low Winstone 98 score for its class.

Everex provides a standard three-year warranty that includes first-year on-site service. The company has live 24-hour, 7-day technical support with guaranteed 24-hour turnaround on replacement parts.

The StepStation 2 offers key manageability factors as well as good service and support, making this system a reasonable choice for corporate buyers.—BB

Everex Systems Inc., Freemont, CA; 800-383-7391, 510-498-1111; fax, 510-683-2186; www.everex.com. Choose 522 at www.pcmag.com/infolink.

Hertz P333e

Pentium II/333, 6.4GB hard disk, 17-inch monitor, 64MB SDRAM. High-End Winstone score: 30.6. \$2,995 direct.

The Hertz P333e offers good manageability features and average performance for a higher-than-average price. Hertz Computer Corp. sells mostly to corporations and government organizations with in-house technical staff that need specialized configurations with high performance and multimedia features.

The unit we tested included an Intel EtherExpress Pro/100+ network card with Wake on LAN and remote power-on/off support; it also came with Intel's LANDesk Client Manager 3.2. The system features heat and voltage monitoring. The unit's case was not tool-free, but it provides ample expansion room and clear access to components. The case is not lockable, however.

The unit is backed by a warranty of three years on parts, one year labor, and one year of on-site service, with standard technical support available during business hours. On-call coverage is available 24 hours. The technical support staff, the same group that custom-configures Hertz computers, is on call to corporate customers, typically working with the in-house support staff rather than end users. Calls for on-site service received before noon are guaranteed a response the next day; 48-hour parts turnaround is guaranteed.

The Hertz PC offers solid management features, and

although it isn't the least expensive one you can buy, the customer-oriented service Hertz offers helps differentiate the company's offerings.—BB

Hertz Computer Corp., New York, NY; 888-222-7280, 212-634-4280; fax, 212-634-4285; www.hertztel.com/comp. Choose 523 at www.pcmag.com/infolink.

HP Vectra VL Series 8



Pentium II/400, 10.1GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 38.4. \$2,750 street.

Hewlett-Packard's Vectra VL Series 8 is a great example of what a managed corporate PC should be. With solid performance and the sophisticated HP TopTools desktop management software, the system offers the right mix of security and manageability for a corporate network.

HP's Vectra line of Pentium and Pentium II corporate PCs are designed to be easy to service and come network-ready. The Series 8 offers a number of useful security and accessibility features including a chassis intrusion detector and a lockable case



HP's Vectra VL Series 8 is a consummate managed PC, offering remote BIOS updates and remote component locking.

McAfee Nuts & Bolts, because we know exactly how you feel.



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that slides off easily after two front-panel latches are lifted. Internal upgrades are easy since the expansion slots are on a riser card, and all expansion cards are secured to the chassis with a strip of metal and a single screw.

The included HP TopTools software offers a more user-friendly and detailed monitoring of fan, memory, and hard disk conditions than the Intel LANDesk Client Manager software bundled with most of the other units reviewed here. The motherboard-integrated HP NightDirector 10/100 PCI Ethernet controller supports remote LAN wake-up, and remote power on and off. The unit allows remote BIOS updates and remote locking of the hard disk, floppy disk drive, and other components.

The unit was also configured with an integrated Matrox PCI graphics solution with 4MB of SGRAM, a generic ISA sound card with an Aztech AZT-2320 FM synthesis audio chip set, and a 24X CD-ROM drive. The HP Vectra VL Series 8 posted an above-average score on our High-End Disk WinMark 98 test and average scores on our remaining tests.

HP provides a three-year warranty including a year of free on-site service, but technical support is available only on weekdays, during extended business hours. A 24-hour parts replacement plan costs \$160 for three years. The HP Vectra VL is a total managed PC solution.—*Robert S. Anthony*
Hewlett-Packard Co., Palo Alto, CA; 800-322-4772, 415-857-1501; fax, 800-231-9300; www.hp.com/vectra. Choose 524 at www.pcmag.com/infolink.

Hymco BTS-605

Pentium II/333, 4.3GB hard disk, 17-inch monitor, 64MB SDRAM. High-End Winstone score: 32.3. \$2,000 direct.

Hymco Technologies' BTS-605 is backed by strong but regionally limited support policies and some good system manageability features. The unit's scores were average for its CPU class across our benchmark tests.

The unit's Intel EtherExpress Pro/100+ PCI network card, along with the installed Intel LANDesk Client Manager, Version 3.11, provides support for Wake on LAN. The system doesn't have chassis intrusion detection or fan monitoring, but it does monitor and track system temperature and voltage levels through the LM75 ASIC. Remote power-on and off is also supported.

The ATX motherboard-equipped Hymco system doesn't make it easy to add memory: RAM slots are buried under a tangle of wires and cables. Drive and card access is fine, however. The case does not offer tool-free access.

Hymco's two-year parts, one-year labor warranty includes on-site support for Bay Area customers, with none available in other areas. According to the company, Hymco has no East

Coast customers. Technical support is available during business hours Pacific time on weekdays, with next-business-day response for on-site service. When parts need to be replaced under warranty, Hymco pays for shipping both ways. Hymco's customers are encouraged to allow Hymco network access for remote diagnosis and service.

Customers outside the San Francisco Bay area are probably best advised to look elsewhere, but Hymco's local focus may add appeal to buyers within that area.—*BB*

Hymco Technologies Inc., San Jose, CA; 408-251-6888; fax, 408-251-2333; www.hymco.com. Choose 525 at www.pcmag.com/infolink.

Maximus Graphics Artist Workstation

Pentium II/350, 8.4GB hard disk, 19-inch monitor, 64MB SDRAM. High-End Winstone 98 score: 31. \$2,799 direct.

Maximus Computers' Graphics Artist Workstation is optimized for multimedia tasks, but it offers just enough manageability features to make it a reasonable corporate PC. Maximus markets a variety of custom Pentium and Pentium II multimedia PCs stressing graphics performance.

The unit came with Intel's LANDesk Client Manager 3.1, which can monitor temperature and voltage. Its Intel EtherExpress 10/100-Mbps PCI adapter supports Wake on LAN. The case is not tool-free, but the interior is uncluttered.

You can release the panel that holds the ATX motherboard just by depressing two clips.

The Maximus unit, which came with a Number Nine Revolution 3D AGP graphics board with 8MB of WRAM, was tied with the SAG STA 350 for the best High-End Graphics WinMark 98 score in its CPU class. Most of the unit's other benchmark test scores were average, save for a below-average High-End Disk WinMark 98 score.

The unit came with a 19-inch CyberVision monitor and an EZ-1000 keyboard, which has a microphone and 18

programmable keys in addition to special application and multimedia keys.

Maximus backs the system with a three-year parts, two-year labor warranty with two years of on-site service and 24-hour, 7-day toll-free technical support. After the second year, toll-free technical support is available six days a week. The system may be overkill for mundane office applications, but it will do well in demanding graphics settings and offers some reasonable management features.—*RSA*

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Mega Double Impact

Pentium II/333, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 32.1. \$2,299 direct.

With solid performance and dual-processor capability, the Mega Double Impact Pentium II/333+ is worth a closer look. The system offers few corporate manageability features, however.

Intel's LANDesk Client Manager 3.0 software came with this system. All basic information was available, and hardware monitoring of fan, temperature, and voltage was properly implemented. No additional management features, such as remote LAN wake-up support or a chassis-intrusion detector, were provided. Chassis-intrusion detection is an option on some models.

The lockable mini-tower case is not tool-free but is accessible and easy to service. The case has a special dust filter in front and plenty of room for expansion.

The unit has some strong components, such as the 8MB Matrox Millennium II AGP card, a top 2-D graphics performer. The system we tested was one of the few with an NTFS-formatted disk, which can be slightly slower than one with FAT partitions, but the Mega's scores were average for its class save for an above-average Business Graphics WinMark 98 score.

The company's Web site, though not extensive, does offer some drivers. Mega offers a two-year warranty; an additional year is \$70. Technical support is limited to weekdays during business hours (Pacific time). On-site service is not offered, but 24-hour parts turnaround is available.

The unit, which comes with a second processor slot, lacks some management features but offers solid performance for its class.—FJE

Mega Computer Systems, San Diego, CA; 800-338-6628, 619-487-8888; fax, 619-485-1518; www.megacs.com. Choose 527 at www.pcmag.com/infolink.

Micro Express MicroFlex-P II/333

Pentium II/333, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 33.9. \$1,999 direct.

The MicroFlex-P II/333 succeeds in delivering great performance—and does so at a very attractive price—and its management features are fairly good.

The unit's case has a chassis intrusion detector that will notify administrators if the case has been opened. The on-board LM78 ASIC provides hardware monitoring of CPU fan, temperature, and voltage, but the main fan is not connected to the motherboard and so cannot be properly monitored. Remote LAN wake-up was available on the motherboard, but Micro

Express chose to add a network card that does not support this feature. The system comes with Intel's LANDesk Client Manager 3.1. The MicroFlex, though lacking a tool-free case, is easy to service and offers plenty of expansion room.

While not billed as a presentation machine, the unit's multimedia components are all top notch—somewhat incongruous in a corporate machine. The system's Number Nine Revolution 3D AGP graphics card is a very good, especially for 3-D functions and its sound card and speakers are excellent. A Creative Labs DVD CD-ROM came with the system, though no DVD software was preinstalled. The unit had terrific performance on most of our tests.

The documentation provided is excellent and all support numbers are listed. Technical support is available round the clock. MicroExpress provides a four-year warranty.

Though not an optimal corporate box, the MicroFlex offers some great components at a very attractive price, coupled with a long warranty, making it a tempting system.—FJE

Micro Express, Irvine, CA; 800-989-9900, 714-852-1400; fax, 714-852-1225; www.microexpress.com. Choose 528 at www.pcmag.com/infolink.

Micro X MPD-8050

Pentium II/400, 8.4GB hard disk, 17-inch monitor, 64MB SDRAM, High-End Winstone score: 36.3. \$2,999 direct.

Micro X classifies the MPD-8050 as basically a Slot 1 Pentium II, and, along with some fair management features, that's what you get: a powerful microprocessor with the new 100-MHz bus in a conventional mid-tower package. Its price is relatively competitive, which might make it a good choice for graphics-intensive work.

The MPD-8050's motherboard allows hardware monitor-

ing of fan speed, temperature, and voltage in full DMI compliance. In addition to Intel's LANDesk Client Manager 3.0, the Micro X unit includes PC Doctor, a system board diagnostic tool, and Lotus SmartSuite 97 (Microsoft Office 97 is a \$99 option). The 3Com Ethernet card supports Remote Wake-up.

The MPD-8050 fits into a solid, somewhat wide (15.5 by 8.5 by 18 inches HWD) steel mid-tower that requires a screwdriver to remove its U-shaped cover-all lid. There are two 5.25-inch external bays and a 3.5-inch internal bay open for expansion. In addition to the basic drives, Micro X also includes a Zip Drive.

All seven slots of the BCM DR-730 motherboard are accessible, though the power supply covers the Pentium II CPU. You can easily reach in to slide another DIMM into the one available



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socket; the other two are filled with the 64MB of standard SDRAM.

The warranty extends to five years on labor and three years on parts; on-site service is a \$25 option. The MPD-8050 was a fair performer except on our disk tests, where it earned below-average scores, and it has fair management capabilities. It's a work-horse machine.—*Winn L. Rosch*

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Micron ClientPro 400

Pentium II/400, 10.1GB hard disk, 17-inch monitor, 64MB SDRAM, High-End Winstone score: 41.0. \$2,749 direct.

The Micron ClientPro 400 succeeds in providing an optimized LANdesk management solution and combines it with top performance at a good price.

Micron also offers the Millennia line of high-performance, standalone systems.

To aid the network administrator, the ClientPro starts with the minimum—DMI 2.0 compliance coupled with Intel's LANdesk Client Manager 3.1. Physical monitoring includes everything most managers will want—intrusion detection, case and CPU temperature sensing, and fan and voltage monitoring. Wake on LAN support is provided through an Intel EtherExpress Pro 100/+ PCI Ethernet network card. The unit also offers remote BIOS update support.

A modest mini-tower, the plastic-covered steel case is easy to open without tools: Release two tabs and slide off the left side. The small motherboard holds six slots as well as three DIMM sockets, one filled with 64MB of ECC SDRAM, a standard feature. The 10GB hard disk (8.4GB is standard) tucks neatly behind the expansion slots, leaving space for two front-accessible 5.25-inch bays (one filled), two 3.5-inch external bays, a 3.5-inch internal bay, and the expected floppy disk drive. The wiring inside was bundled but snarled. A supplemental 4-inch fan helps keep everything cool, sucking air out from around the CPU.

The unit did exceptionally well on all our benchmark tests, with top scores on both groups of Winstone tests.

This well-constructed system comes with a three-year parts warranty (five years on CPU and memory) with one-year on-site service and round-the-clock toll-free technical support. Micron emphasizes the ClientPro's manageability—with good reason—but its real strength (and why you want one) is its speed.—*WLR*

Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; fax, 208-893-3424; www.micronpc.com. Choose 530 at www.pcmag.com/infolink.

Monorail NPC 7230 NT

Pentium II/333, 4.3GB hard disk, 15-inch monitor, 64MB SDRAM. High-End Winstone score: 32.9. \$2,200 street.

The Monorail NPC 7230 NT has some good management features, but you may find better values elsewhere. Monorail sells its PCs (manufactured by SCI Systems Inc.) mainly to corporations through Tech Data and Ingram Micro and through retailers such as CompUSA and Circuit City.

The unit came with Intel's LANdesk Client Manager 3.1 and supports fan, temperature, and voltage monitoring. Its

Intel network card supports Wake on LAN. The NPC 7230 NT is not lockable, but sensors will notify administrators of chassis intrusions. The case, though not tool-free, is easy to work on, and everything is readily accessible.

We had some problems fully testing the system we received.

Initially, the floppy disk drive did not function, and there were some graphics driver incompatibilities. Monorail's Web site did not provide new drivers during our testing, but it should by the time you read this. A minor point: The power button handles both suspend and on/off capability. To power

down the system, you must depress the button for more than four seconds. That can

be confusing, but the feature can be disabled in BIOS. We also found the output of the included 15-inch monitor grainy (currently Monorail sells systems with this monitor only).

The NPC 7230 NT was an average performer on most of our tests, except for an above-average CD-ROM WinMark score.

Monorail offers a three-year-parts, one-year-labor warranty and a year of on-site service; 24-hour, 7-day technical support is available through Digital.

Although the unit has average performance and good management features, you may find better bargains elsewhere.—*FJE*
Monorail Computer Corp., Marietta, GA; 888-880-7245, 770-421-1102; fax, 770-422-6671; www.monorail.com. Choose 531 at www.pcmag.com/infolink.

NEC PowerMate 8100

Pentium II/400, 10.1GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 37.6. \$3,200 street.

The NEC PowerMate 8100 offers good management features and serviceability as well as solid performance. NEC also markets the Direction line of performance standalone systems, and the Ready line of home PCs.



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Through Intel's LANDesk Client Manager 3.1, the PowerMate features well-implemented DMI functionality. The system includes chassis intrusion alerts, monitoring of CPU temperature, fan, and voltage, and Wake on LAN support, as well as a SMART 10.1GB hard disk. As an added security feature to prevent unauthorized tampering with settings, you cannot reset BIOS settings unless you open the case and reset the jumpers to configuration mode (there are two other levels of access: view-only and no access at all). The unit also offers remote BIOS updating.

The PowerMate's chassis is also well-designed. It has a tool-free, easy-to-remove L-shaped side/top panel, which provides ready access to the unit's interior. There is a fair amount of expansion room, and components are unobstructed. A riser card holds the ISA and PCI slots, leaving the motherboard clear. The chassis is lockable.

NEC offers round-the-clock technical support. The PowerMate 8100 comes with a three-year warranty.

With its well-implemented LANDesk-based management solution, the PowerMate 8100 is sure to please corporate buyers.

—Arie Moller

NEC Computer Systems Division, Mountain View, CA; 888-863-2669, 978-264-8000; fax, 978-264-8673; www.nec-computers.com. Choose 532 at www.pcmag.com/infolink.

NexTrend NexStar-333

Pentium II/333, 8.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 31.5. \$2,129 direct.

NexTrend Technology's NexStar-333 is an average system with solid performance and fair management support.

The unit comes with DMI 2.0 support in the BIOS and motherboard, with Intel's LANDesk Client Manager 3.1 to watch over things. Hardware monitoring of fan, temperature, and voltage is included. Remote wake-up support is integrated.

Mechanically, the system is sparse. You can easily access the interior by sliding off the metal-lined plastic panel on the side of the mid-tower, held tight by two plastic tabs. The inside is uncluttered. All seven slots (two ISA, three PCI, one combination, and one AGP), the CPU, and the four DIMM sockets are in plain sight, with only the CD-ROM audio cable snaking through to mar the view. Notable is a 4-inch fan that blows across the CPU, supplementing the integral fan on the heat sink of the processor. Two free 5.25-inch external bays and an internal 3.5-inch bay provide expansion space.

NexTrend claims to tune the NexStar for upper-end performance, and our test results bear that out: Its scores were average to above average on all tests save the CD-ROM WinMark 98

test, where it was last in its CPU class.

To get you started, NexTrend includes a brief overview manual and a motherboard manual that has more detail than you may want, as well as component manuals. The system is covered for three years on parts and one year labor, with on-site service.

The NexStar has some good management features to recommend it and may just be what the average office worker needs.—WLR

NexTrend Technology Inc., Fremont, CA; 888-838-7827, 510-659-8500; fax, 510-659-8692; www.nexttrendpc.com. Choose 533 at www.pcmag.com/infolink.

Polywell Poly 733MD2

Pentium II/333, 8.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone score: 33.7. \$2,349 direct.

With a case only slightly smaller than a junior executive cubicle, the towering Polywell 733MD2 gives you lots of room to grow. Side-step the immense size, however, and you have a reasonably priced, custom-configured PC with good manageability

and moderate performance. In other words, you pay no penalty for the Poly 733MD2's expand-

ability, and you get a lot to work with.

Built around a SuperMicro Super P6DLE motherboard using the Intel 440LX chip set, the Polywell unit follows all of today's prevailing standards—ACPI, DMI, and PC98—and supports a wealth of management features from Wake on LAN to seven on-board voltage monitors, a three-state fan status monitor, temperature measurement, and intrusion detection. The six-slot motherboard also includes four DIMM sockets (one filled with 64MB of ECC SDRAM), a slot for a second CPU, and all ports except for a game port and audio jacks. The unit came with Intel's LANDesk Client Manager 3.1.

You get inside the case by unscrewing and prying off the left side; once there, you'll find plenty of expansion space and all components readily accessible. Both side panels need to be removed to get to the other side of the drives.

The generalist manual, however, meant to cover everything from microprocessors to using the keyboard, is weak and fails to tie together the package you get. On the other hand, the system is backed by a five-year labor, three-year parts warranty with one year of 24-hour technical support. On-site service is \$75 for the first year.

If you want the space for expansion and need good management features, the Poly 733MD2 should be a good fit.—WLR
Polywell Computer Inc., So. San Francisco, CA; 800-999-1278, 650-583-7222; fax, 650-583-1974; www.polywell.com. Choose 534 at www.pcmag.com/infolink.



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Premio Shadowhawk LX 333

Pentium II/333, 8.4GB hard disk, 17-inch monitor, SDRAM; High-End Win-stone score: 30.0. \$2,800 street.

The most striking aspect of the LX333 from Premio Computer is its charcoal black color. Underneath its pretty face (the unit also comes in conventional beige) you'll find a well-made system with average management abilities. But when you consider the price, this exemplar of the LX series is pretty well out of contention.

Not that there is anything wrong with the Shadowhawk LX333 series. The Premio-made motherboard, based on the Intel 440LX chip set, is DMI 2.0-compliant, and the unit comes with Intel's LANdesk Client Manager 3.1. The unit also offers hardware monitoring of fan, temperature, and voltage.

Servicing the Shadowhawk is fairly easy, though not tool-free. Removing two screws lets you into the left side of the all-steel mid-tower shell to access the seven expansion slots and three DIMM sockets. Adding a hard disk, which requires removing a sub-bay for access to free drive bays, is only slightly more complicated.

This 333-MHz Pentium II system delivered average performance on most of our tests but had below-average results on our Disk WinMark tests.

Documentation is one of Premio's strong points. The LX-series includes a very thorough illustrated and indexed user guide—good enough for a direct vendor even though the system is marketed through resellers. The system also comes with all the peripherals' manuals.

The unit has a three-year warranty (two years on the motherboard); on-site service is \$50 per year. This average system offers some fair management features, but you can find a better value elsewhere.—WLR

Premio Computer Inc., City of Industry, CA; 800-677-6477, 626-333-5121; fax, 626-369-6803; www.premiopc.com. Choose 535 at www.pcmag.com/infolink.

ProGen Venture Pro 350

Pentium II/350, 8.4GB hard disk, 17-inch monitor, SDRAM. High-End Win-stone score: 33.9; \$2,049 direct.

Conventional in design and execution, the ProGen Venture Pro 350 aims to deliver superior value. It achieves that worthy goal and provides some good management capabilities.

DMI 2.0 support with Intel's LANdesk Client Manager 3.1 are standard. The unit also came with an LM78 ASIC to monitor fan, temperature, and voltage. Its network card supports Remote Wake-up.

The system is neither particularly easy nor difficult to maintain: Unscrew the big, U-shaped steel lid and the only notable feature are two reinforcements: a rail halfway down the left side and another panel on the right. The latter covers access to screws on one side of the drive bays, making drive installation in the two available external 5.25-inch bay and two internal 3.5-inch bays slightly more difficult. Nothing blocks access to the three DIMM sockets and seven slots, but you can't pull the CPU without moving the motherboard or power supply.

The unit did get good scores on most of our tests, however. ProGen includes a Microsoft Natural keyboard but makes application software (Office 97 Small Business Edition) a \$199 option. Documentation includes a slim user's guide with a good quick-start section and more extensive support from manuals for various drivers and peripherals.

The system has a solid warranty: three years on parts, one year on-site service, with round-

the-clock technical support to be available by the time you read this. The Venture is an average PC with some manageability features; you may find it a good value.—WLR
ProGen Systems, Tustin, CA; 800-848-1353, 714-566-9200; fax, 714-566-9267; www.progen.com. Choose 536 at www.pcmag.com/infolink.

Quantex QP6/400 SB-3x

Pentium II/400, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Win-stone 98 score: 36.2. \$2,249 direct.

The Quantex Microsystems QP6/400 SB-3x offers fair management capabilities and some good features at a very appealing price, especially for a 400-MHz unit. The machine is part of Quantex's SB line of small-business PCs. The mail-order vendor also offers the SM power multimedia line and the M series of value multimedia PCs.

Quantex modifies the included copy of Intel's LANdesk Client Manager 3.1 for its systems and calls it Qsentry. Qsentry was able to browse the machine's hardware, and the unit comes with an LM78 ASIC to monitor fan, temperature, and voltage. The Intel EtherExpress PRO/100 card supports Wake on LAN. The mid-tower case can be opened by removing three thumb-screws, providing clear access to components, and has plenty of room for expansion.

The Quantex QP6/400 SB-3x we tested was configured with a relatively low-capacity 4.3GB IBM hard disk. Graphics were handled by a Diamond Multimedia Viper V330 AGP graphics card with 4MB of SGRAM. The Intel motherboard offers an integrated Crystal audio chip set, but it was disabled in favor of



an Ensoniq Audio PCI Card. Also included is a pair of Altec Lansing ACS90 bookshelf speakers.

The unit earned average results for its class on most of our tests but had very low results on our disk tests.

Quantex provides a three-year-parts, one-year-labor warranty with a year of on-site service and offers 24-hour technical support. A good price is complemented by mostly average performance and reasonable management features in the unit.—**RSA**.
Quantex Microsystems Inc., Somerset, NJ; 800-346-6685, 732-563-4166; fax, 732-563-0407; www.quantex.com. Choose 537 at www.pcmag.com/infolink.

Reason Square 6-II SE/BX

Pentium II/333MHz, 8.4GB hard disk, 19-inch monitor, SDRAM. High-End Winstone score: 30.3. \$2,295 direct.

The Reason Square 6-II SE/BX has a few unexpected features and fair management capability, but you'll find better bargains elsewhere. The unit is aimed at price-conscious small to mid-size businesses.

The unit's network card supports Wake on LAN, and it came with Intel's LANdesk Client Manager 3.1. The system lacks a chassis intrusion detector but offers hardware monitoring of fan, temperature, and voltage through the LM79 ASIC.

The Square 6 has enough room for expansion and readily accessible components. The tested unit's case (not tool-free) had a troublesome On switch that required removal of the front bezel to correct.

Notably, the unit came with a Princeton EO90 19-inch monitor—one of two systems with a 19-inch monitor in this roundup. Instead of the standard floppy disk drive, the unit features an LS120 drive, which can read both 120MB cartridges and standard floppy disks. The Reason Square 6 we tested also uses the Intel 440BX chip set, which was designed primarily for 350-MHz or faster CPUs, so you have an upgrade path to the 100-MHz bus. (Reason says it will continue to offer this combination.)

We suspect the unit had graphics driver problems which prevented it from completing our 32-bit graphics tests. Replacement drivers the company sent did not solve the problem. The unit's performance on the rest of our tests was average for its class.

Reason offers a six-year labor, three-year parts warranty. Technical support is available six days a week during business hours (Central time). Reason promises 24-hour turnaround on repairs.

The Square 6 is an average system with some good components.—**AM**

Reason Computer Inc., Lino Lakes, MN; 800-800-4860, 612-717-3600; fax, 612-717-3601; www.reasoncomputer.com. Choose 538 at www.pcmag.com/infolink.

Royal Xpert SE-17

Pentium II/350, 6.4GB hard disk, 17-inch monitor, SDRAM, High-End Winstone score: N/A. \$1,390 street.

Royal Computer's Xpert SE-17, aimed at the small-office market, seeks to walk the fine line between price, manageability, and power. Out of the three, it manages to accomplish one of these objectives with gusto, and the other two to a lesser extent. At \$1,390, the Xpert SE-17 is lowest-priced system in this roundup and almost 40 percent below the average. For that you get a 350-MHz CPU and a 6.4GB hard disk, and some reasonable management features. Performance was problematic, however.

Due to problems with graphics drivers, the unit was unable to complete many of our benchmark tests, including both ZD High-End Winstone 98 and ZD Business Winstone 98. New drivers and a new system did not solve the problem. The unit's 3Dlabs Permedia 2-based graphics adapter, which adds OpenGL support, should be capable of fairly average 2-D and Direct-X-based 3-D performance. The Xpert's Maxtor hard disk delivered below-average results for its CPU class.

While the Xpert SE-17 lacks notification of chassis intrusion, fan, voltage, and thermal monitoring are supported. The unit came with Intel's LANdesk

The Royal system offers an adequate management solution, but its graphics drivers caused problems on our tests.

Client Manager 3.1.

The case is not tool-free, but it does allow room for expansion. Some components, however, are difficult to access: To get to the Pentium II processor, for example, you need to remove the power supply.

The unit comes with a one-year warrantee. Technical support is available six days a week during business hours, Pacific time.

The Royal unit boasts a very low price and offers basic management features, but performance and support are sub-par.—**AM**
Royal Computer Inc., City of Industry, CA; 800-486-0008, 626-855-5077; fax, 626-330-2717; www.goroyalpc.com. Choose 539 on www.pcmag.com/infolink.

SAG STA 350

Pentium II/350, 9.1GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 34. \$2,550 direct.

With the STA 350, SAG Electronics provides an adept Intel LANdesk-based solution for networked corporate environments with mostly above-average performance. SAG markets customized PCs, servers, and workstations as well as RAID and high-capacity storage solutions.

The system supports Wake on LAN as well as remote power-down and power-up. A bundled copy of Intel's LANdesk Client



ROYAL XPERT SE-17

Manager 3.1 monitors thermal and voltage alerts. By the time you read this, SAG expects to have added a CPU fan with monitoring to its models. The unit's chassis, while not tool-free, is uncluttered; it offers reasonable expansion room and allows access to all components. The case lacks a lock but includes an intrusion detector.

The STA 350 desktop came with some of the fastest hardware in this roundup. The system was configured with a 7,200-rpm Seagate 9.1GB hard disk as well as a Toshiba 32X CD-ROM drive. Also included was a Number Nine Revolution 3D AGP graphics card with 8MB of WRAM and an Intel EtherExpress Pro 10/100-Mbps PCI Ethernet card. The motherboard includes an integrated FM synthesis audio subsystem with a Crystal chip set.

The STA 350 was the best performer in its CPU class on many of our tests. Its CD-ROM WinMark 98 score was average.

SAG backs the STA 350 with a three-year warranty (five years on the CPU). On-site service is \$75 per year, and SAG expects to provide 24-hour technical support as of May 1. The STA 350 is a complete solution with the storage, performance, and remote management features needed in a corporate PC.—RSA

SAG Electronics, North Andover, MA; 800-989-3475, 978-683-0339; fax, 978-689-0180; www.sagelec.com. *Choose 540 at www.pcmag.com/infolink.*

SIA P6/333-Pentium II Mid Tower

Pentium II/333, 8.4GB hard disk, 15-inch LCD monitor, SDRAM. High-End Winstone 98 score: 32.6. \$2,939 direct.

SIA Computer Corp.'s SIA P6/333-Pentium II Mid Tower offers enough serviceability and management features to make it a worthy office PC, topped off with average performance. What makes its price higher than that of most others in its class is the included 15-inch ViewSonic LCD panel; with a standard 17-inch ViewSonic monitor, the price drops to \$1,994. SIA, the successor to System Integration Associates, customizes hardware for the newspaper industry and offers built-to-order PCs to corporate, government, and individual customers. The company has been in the PC business since 1983.

The unit's tool-free case opens after two thumbscrews are removed. It offers clear access to the Intel AL440LX ATX motherboard, which carries an integrated audio subsystem with a Yamaha audio chip set. Using the included copy of Intel's LANDesk Client Manager 3.2, the motherboard supports hardware, voltage, and thermal monitoring. The inside of the case has five open drive bays, an intrusion detector, a map of the motherboard, and an add-on thermal alarm. ECC memory is included, and a 3Com Fast EtherLink XL 10/100Mbps Ethernet card allows Remote Wake-up.

Our test unit came with a Diamond Multimedia Viper V330

AGP graphics card that had 4MB of SGRAM and an nVidia RIVA 128 graphics chip set. The ViewSonic VPA150 15-inch color LCD monitor has built-in stereo speakers.

The SIA P6/333-Pentium II Mid Tower was an average performer across our tests, save for an above-average score on our Business Graphics WinMark test.

SIA backs the unit with a three-year warranty and 24-hour parts replacement, but standard technical support is available only during weekday business hours. With adequate performance and manageability features, the SIA P6/333-Pentium II Mid Tower is a solid managed PC.—RSA

SIA Computer Corp., Richmond, IL; 815-678-2224; fax, 815-678-6789; www.siacomputer.com. *Choose 541 at www.pcmag.com/infolink.*

Sys Performance Pro 400BA

Pentium II/400, 8.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 41.0. \$2,597 direct.

In addition to high-end multimedia hardware, the Sys Performance Pro 400BA offers adequate remote-management features and a stunning level of performance. It should appeal to its target market of individual and corporate users seeking high performance.

The Pro 400BA supports Remote Wake-up as well as thermal, CPU fan, and voltage monitoring. It comes with Intel's LANDesk Client Manager 3.04d (3.1 should be available by the time you read this), which can monitor most key components. The unit lacks a lockable case or an intrusion alarm, however. Included is a 3Com Fast EtherLink XL 10/100-Mbps PCI Ethernet card. The interior is roomy and easy to service, and the Giga-Byte GA-686BX motherboard's jumper settings are well

labeled. The case is not tool-free, however.

The system comes with high-

end audio and graphics hardware, including a Creative Labs Sound Blaster AWE64 sound card, a Matrox Millennium II AGP graphics card with 8MB of WRAM, and a 32X TEAC CD-ROM drive.

Bolstered by its advanced graphics hardware, the Pro 400BA yielded the best High-End Winstone 98 and High-End Graphics WinMark 98 scores in this roundup. Its High-End Disk WinMark 98 score was also one of the best, but its CD-ROM WinMark 98 score was far below average.

Sys Technology backs the Pro 400BA with a year of 24-hour, toll-free support (business hours, weekdays after the first year), a six-year warranty on the CPU and RAM, and five years of free labor. Components are covered by manufacturers' warranties.



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"Where'd you get that?"

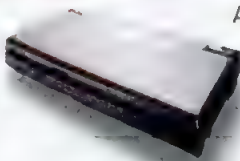
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SUMMARY OF FEATURES

Managed PCs

Price of tested configuration For PCs sold through resellers, assume that street prices are 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices. In such cases, we indicate that the cited price is a street price, rounded to the nearest \$10. Some vendors sell directly to customers. In those cases, we list the prices as *direct*; they are not discounted. Each price includes a monitor.

Hard disk interface Ultra ATA, Ultra ATA-3, and ATA-4 drives comply with the Ultra DMA specification, which supports a burst throughput of up to 33.3 MBps. To obtain the full benefit of Ultra DMA, vendors must switch this mode on in BIOS. If the switch is not turned on, the disk will default to PIO mode 3 or 4. PIO mode 3 has a maximum burst throughput of 13.3 MBps; PIO mode 4 has a maximum burst rate of 16.7 MBps.

Graphics interface Accelerated Graphics Port (AGP) is a high-speed, point-to-point connection between the system chip set and the graphics chip. Graphics cards that use AGP can access system memory directly through the system chip set at memory-bus speeds, which are faster than standard PCI connections. AGP also provides a cost-effective way for graphics subsystems to access large amounts of memory for fast 3-D rendering. Many graphics subsystems still go through the PCI bus, either through an adapter card or through an integrated chip set.

Monitor (measured diagonal size, in inches) We measure and list the viewable diagonal size of each monitor.

CD-ROM drive speed We list only the maximum speed of each CD-ROM drive.

Sound device All integrated audio chip sets are ISA-based and located on the motherboard. For card-based sound solutions, we list the bus interfaces in parentheses.

■ YES ■ NO □ OPTIONAL

	Aberdeen Inverness 350	Acer AcerPower 8000	ACMA N Pow. 333	3.
Price of tested configuration	\$2,495 direct	\$2,790 street	\$1,995 direct	3.
Processor	Pentium II/350	Pentium II/400	Pentium II/333	Pentium II
Installed RAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM
Hard disk	Seagate ST 36451A	IBM DHEA-36481	Quantum Fireball SE 4.3A	IBM DHEA-36
Capacity and interface	6.4GB Ultra ATA-3	6.4GB Ultra ATA	4.3GB Ultra ATA	6.4GB Ultra ATA-3
Graphics adapter and interface	Diamond Viper V330 AGP	Integrated AGP	Diamond Viper V330 AGP	AGP-9800 AGP
Graphics memory	4MB SGRAM	4MB SGRAM	4MB SGRAM	4MB SGRAM
Graphics chip set	nVidia RIVA 128	ATI Rage Pro	nVidia RIVA 128	Trident 3DImage 9850
Monitor (measured diagonal size, in inches)	ViewSonic G771 (16.1)	Acer View 79G (15.7)	Impression 7VX (15.8)	CyberVision DS69T (16.0)
Installed Level 2 cache and type	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst
Motherboard manufacturer	Intel	Acer	Intel	Giga-Byte
Chip set	Intel 440BX	Intel 440BX	Intel 440LX	Intel 440BX
BIOS manufacturer and version (or date)	Phoenix 4.0 Release 6.0	Acer (2/20/98)	Phoenix 4.0 Release 6.0	Award (2/20/98)
CD-ROM drive speed and model	32X Toshiba XM- 6202B CD-ROM	32X Acer CD-932E/AKU CD-ROM	32X Toshiba XM- 6202B CD-ROM	32X Toshiba XM- 6202B CD-ROM
MPEG-2 support	Software	Software	None	Software
Hardware manufacturer and model	N/A	N/A	N/A	N/A
Sound device	Integrated Crystal CS4236b	Integrated Crystal CS4235-jq	Integrated Yamaha OPL 3-SA3	Creative Labs Sound Blaster AWE64 (ISA)
MIDI synthesis type	FM	FM	FM, wavetable	FM, wavetable
Network adapter	Intel EtherExpress Pro/100B PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100B PCI	Intel EtherExpress Pro/100+ PCI
Expandability				
Maximum RAM	384MB	384MB	384MB	512MB
Expansion-bus slots	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 PCI, 1 PCI/ISA	1 ISA, 1 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	2 / 3	3 / 2	1 / 1	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 2	0 / 0	0 / 1	0 / 2
Power-supply wattage	235	235	200	235
Parallel/serial ports	1 / 2	1 / 1	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2
Service and Support				
24-hour, 7-day live technical support	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	3 years/3 years	3 years/1 year	1 year/1 year
On-site service charge	\$199.95 (4 years)	Included (1 year)	Included (1 year)	\$179.95 (4 years)
24-hour turnaround for parts replacement	■	■	■	■

N/A—Not applicable: The product does not have this feature.

The Pro 400BA sets a high standard for performance, and it offers some good management features.—*RSA*

Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592. www.systechtechnology.com. Choose 542 at www.pcmag.com/infolink.

Tangent Medallion

Pentium II/333, 4.3GB hard disk, 17-inch monitor, SDRAM. High-End Win-stone 98 score: 27.3. \$1,955 direct.

The Tangent Medallion offers some good desktop management features at an attractive price, but it could not keep up with the competition on most of our tests. Tangent custom-builds PCs for

individuals, government, and corporate buyers.

The system came with a dual-CPU Tyan motherboard, though just one processor was installed. The unit's Intel Ether-Express Pro/100+ network card supports Wake on LAN, and its motherboard supports intrusion detection, but no intrusion alarm was installed (this feature is standard only on the full-tower model). The Medallion supports thermal, voltage, and CPU fan monitoring with the included Intel LANdesk Client Manager 3.1; Farralon Computing's Timbuktu Pro remote-control software can be added for \$99. The case offers room for expansion, but the DIMM memory slots are hidden behind a tangle of cables and the drive bays.



Compaq Deskpro EN Series	Comtrade Streamer Pro AGP 333	Dell OptiPlex GX1	Digital PC5510 6333ST	DTK APRI-76M/P333	Everex StepStation 2 Model PII333	Hertz P333e	HP Vectra VL Series 8		
\$2,250 direct Pentium II/333 64MB SDRAM Quantum Fireball SE 4.3A 4.3GB Ultra ATA ATI Xpert@Play 8MB SGRAM ATI Rage Pro ArtMedia Trinitron TX1864 (16.0) 512K pipelined-burst Asus Intel 440LX Award 4.51PG 32X Toshiba XM-6202B CD-ROM Hardware ATI Xpert@Play Creative Labs Sound Blaster AWE64 (ISA) FM, wavetable 3Com Fast Etherlink XL PCI	\$1,780 street Pentium II/333 64MB SDRAM Maxtor 848006 Western Digital Cavalier 4.34300 4.3GB Ultra ATA Matrox Millennium AGP 4MB WRAM Matrox MGA-2164WA-B Sceptre P72SA (16.0) 512K pipelined-burst ABit Intel 440LX Award 4.51PG 32X Toshiba XM-6202B CD-ROM None N/A Creative Labs Sound Blaster AWE64 (ISA) FM, wavetable 3Com Fast Etherlink XL PCI	\$3,330 street Pentium II/400 64MB SDRAM Maxtor 848006 6.4GB Ultra ATA ATI Xpert@Play AGP 4MB SGRAM ATI Rage Pro Compaq V75 (16.0) 512K pipelined-burst Compaq Intel 440BX Compaq (2/27/98) 24X Matsushita CR-587B CD-ROM Software N/A Integrated ES1869F FM Compaq Netelligent 10/99 PCI	\$2,180 street Pentium II/333 4MB SDRAM BM DHEA-38451 3.4GB Ultra ATA-3 Diamond Fire GL 1000 Pro AGP 8MB SGRAM 3DLabs Permedia 2 Viewmate vm-17e (16.0) 512K pipelined-burst Giga-Byte Intel 440LX Award 4.51PG 24X Toshiba XM-6102B CD-ROM Hardware 3DLabs Permedia 2 Diamond Sonic Impact (PCI) FM, wavetable Intel EtherExpress Pro/100B PCI	\$2,803 direct Pentium II/400 64MB SDRAM Maxtor 8432004 4.3GB ATA-4 Integrated AGP 8MB SGRAM ATI Rage Pro Dell UltraScan 1000HS (16.0) 512K pipelined-burst Dell Intel 440BX Dell X11 32X NEC XM-1900A CD-ROM Software N/A Integrated Crystal CS4236b FM, wavetable 3Com Fast Etherlink XL PCI	\$2,989 direct Pentium II/333 64MB SDRAM Quantum Fireball SE 6.4A 6.4GB Ultra ATA Diamond Fire GL 1000 Pro AGP 8MB SGRAM 3DLabs Permedia 2 Digital PCXBU-FZ (15.7) 512K pipelined-burst Digital Intel 440LX Phoenix/Digital 1.05 32X Toshiba XM-6202B CD-ROM Hardware 3DLabs Permedia 2 Integrated Crystal CS4236b FM Digital 21143 Ethernet PCI	\$2,000 street Pentium II/333 64MB SDRAM Seagate ST 36451A 6.4GB Ultra ATA-3 Matrox Productiva G100 AGP 8MB SDRAM Matrox MGA-G100A-D DTK MD-1737 (16.5) 512K pipelined-burst DTK Intel 440LX Award (2/11/98) 32X Toshiba XM-6202B CD-ROM None N/A Creative Labs Sound Blaster 16 WaveEffects (ISA) FM Intel EtherExpress Pro/100+ PCI	\$2,180 street Pentium II/333 64MB SDRAM Seagate ST 36451A 6.4GB Ultra ATA-3 Yuan 300S AGP 4MB SGRAM nVidia RIVA 128 Comfortview 17CX (15.9) 512K pipelined-burst FIC Intel 440LX AMI Ver 2.5 32X Toshiba XM-6202B CD-ROM Software N/A Formosa SND-21 (ISA) FM, wavetable Intel EtherExpress Pro/100B PCI	\$2,995 direct Pentium II/333 64MB SDRAM Seagate ST 36451A 6.4GB Ultra ATA-3 Number Nine Revolution 3D PCI 4MB WRAM Number Nine Ticket to Ride Sampo Alpha-Scan 761 (16.0) 512K pipelined-burst Intel Intel 440LX Phoenix 4.0 Release 6.0 32X Toshiba XM-6202B CD-ROM None N/A Integrated Yamaha OPL3 FM, wavetable Intel EtherExpress Pro/100+ PCI	\$2,750 street Pentium II/400 64MB SDRAM IBM DTTA-371010 10.1GB Ultra ATA-3 Integrated AGP 4MB SGRAM Matrox MGA-G100A-D HP Ultra VGA 1280 (15.7) 512K pipelined-burst HP Intel 440BX Phoenix 4.0 Release 6.0 24X Hitachi CDR-8430 CD-ROM None N/A AzTech AZT-2320 (ISA) FM HP NightDirector 10/100 BT PCI
512MB 1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP 3/2 0/2 235 1/2 1/2	348MB 2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP 4/2 0/2 235 1/2 1/2	384MB 2 PCI, 2 PCI/ISA, 1 AGP 2/1 0/1 200 1/2 1/2	640MB 2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP 3/2 0/2 235 1/2 1/2	384MB 2 ISA, 3 PCI, 2 PCI/ISA 3/1 0/2 230 1/2 1/2	384MB 1 ISA, 1 PCI, 2 PCI/ISA, 1 AGP 3/1 0/2 235 1/1 1/2	512MB 1 ISA, 3 PCI, 3 PCI/ISA, 1 AGP 3/2 0/1 115 1/2 1/2	384MB 1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP 3/2 0/2 235 1/2 1/2	384MB 1 ISA, 3 PCI, 1 PCI/ISA 3/3 0/0 230 1/2 1/2	384MB 1 ISA, 1 PCI, 3 PCI/ISA 3/1 0/2 235 1/1 1/2
1 year/3 years Included (1 year)	2 years/1 year Included (1 year)	3 years/1 year Included (1 year)	1 year/1 year \$25 (1 year)	3 years/1 year Included (1 year)	3 years/3 years Included (1 year)	2 years/2 years \$50 per year	3 years/3 years Included (1 year)	3 years/1 year Included (1 year)	3 years/3 years Included (1 year) □ (3 years, \$160)

The mid-tower unit came with an STB Velocity 128 AGP graphics card with 4MB SGRAM and an nVidia RIVA 128 graphics chip set; it also had an Aztech PCI-128 Wave sound card and a Toshiba 32X CD-ROM drive (a 36X drive is now standard).

The Medallion yielded below-average scores for its CPU class on most of our tests. Its CPUmark₃₂ and CD-ROM WinMark 98 scores were average, however.

Tangent backs the unit with a three-year warranty on most parts except the monitor, keyboard, and mouse (one year) and processor and RAM (five years). The company offers lifetime toll-free technical support six days a week.

The Medallion offers some good management features at a

reasonable price; the tradeoff is in performance.—RSA
Tangent Computer Inc., Burlingame, CA; 888-826-4368, 650-342-9388; fax, 650-342-9380; www.tangent.com. Choose 543 at www.pcmag.com/infolink.

TigerDirect TigerPro 333 NT

Pentium II/333, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 33.0. \$2,399 direct.

With fair-to-middling performance, basic management features, and an underutilized motherboard, the TigerPro 333 NT mid-tower comes up a bit short when compared with the other managed PCs in this roundup. TigerDirect, a large catalog vendor of

SUMMARY OF FEATURES

Managed PCs

■ YES ■ NO	Hymco BTS-605	Maximus Graphics Artist Workstation	Mega Double Impact Pentium II/333+ System	Micro Express MicroFlex-PII/333	Micro X MPJ-8050	Micron Cite. 400	Monorail NPC 7230 NT
Price of tested configuration	\$2,000 direct	\$2,799 direct	\$2,299 direct	\$1,999 direct	\$2.99 direct	\$2,749 direct	\$2,200 direct
Processor	Pentium II/333	Pentium II/350	Pentium II/333	Pentium II/333	Pentium II/400	Pentium II/400	Pentium II/333
Installed RAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM
Hard disk	Quantum Fireball SE 4.3A	IBM DHEA-38451	IBM DHEA-34330	Quantum Fireball SE 8.4A	Quantum Fireball ST 3.1	IBM Ultra 37 (16.0)	IBM Ultra 37 (16.0)
Capacity and interface	4.3GB Ultra ATA	8.4GB Ultra ATA-3	4.3GB Ultra ATA	4.3GB Ultra ATA	8.4GB Ultra ATA	10.1GB Ultra ATA-3	4.3GB Ultra ATA-3
Graphics adapter and interface	ATI Xpert@Work 2X AGP	Number Nine Revolution 3D AGP	Matrox Millennium II AGP	Number Nine Revolution 3D AGP	Diamond Fire GL 1000 to AGP	Diamond Viper V330 AGP	3DLabs Permedia 2 Vision AGP
Graphics memory	8MB SGRAM	8MB WRAM	8MB SGRAM	8MB WRAM	8MB SGRAM	4MB SGRAM	8MB SGRAM
Graphics chip set	ATI Rage Pro	Number Nine Ticket to Ride	Matrox MGA-2164WA-B	Number Nine Ticket to Ride	3DLabs Permedia 2	nVidia RIVA 128	3DLabs Permedia 2
Monitor (measured diagonal size, in inches)	ViewSonic 1786PS (18.0)	CyberVision C92 (18.0)	Iiyama Vision Master17 (16.0)	Impression 7 Plus NO-D8770BA (18.0)	MAG D-717 (16.0)	Micron 700FGX (16.0)	Monorail M-150 (13.8)
Installed Level 2 cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard manufacturer	Intel	BCM	SuperMicro	Micro Express LX	BCM	Intel	ECS
Chip set	Intel 440LX	Intel 440BX	Intel 440LX	Intel 440LX	Intel 440E	Intel 440BX	Intel 440LX
BIOS manufacturer and version (or date)	Phoenix 4.0 Release 6.0	Award 4.51PG	AMI (7/15/98)	Award 4.51PG	Award (10/97)	Phoenix 4.0 Release 6.0	Award 4.51PG
CD-ROM drive speed and model	24X Toshiba XM-6102B CD-ROM	32X Toshiba XM-6202B CD-ROM	32X Toshiba XM-6202B CD-ROM	8X Creative Labs 2240E DVD-ROM	32X Toshiba XM-6202B CD-ROM	32X Pioneer CD-504SCN CD-ROM	32X TEAC CD-532E CD-ROM
MPEG-2 support	None	Software	Software	Software	Hardware	Software	Hardware
Hardware manufacturer and model	N/A	N/A	N/A	N/A	3DLabs Permedia 2	N/A	3DLabs Permedia 2
Sound device	Integrated Yamaha OPL3-SA	Creative Labs Sound Blaster AWE64 (ISA)	Creative Labs Sound Blaster AWE64 (ISA)	Creative Labs Sound Blaster AWE64 (ISA)	Ensoniq ES370 (PCI)	Integrated Crystal CS4611-CM EP	ESS ES1869F (ISA)
MIDI synthesis type	Wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable
Network adapter	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100B PCI	3Com Fast EtherLink XL PCI	3Com Fast EtherLink XL PCI	3Com Fast EtherLink XL PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100+ PCI
Expandability							
Maximum RAM	384MB	384MB	512MB	512MB	640MB	384MB	384MB
Expansion-bus slots	1 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	3 / 2	3 / 1	3 / 1	3 / 2	3 / 2	2 / 3	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 2	0 / 2	0 / 2	0 / 1	0 / 1	0 / 2	0 / 3
Power-supply wattage	235	235	235	235	235	235	230
Parallel/serial ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Service and Support							
24-hour, 7-day live technical support	■	■	■	■	■	■	■
Standard warranty on parts/labor	2 years/1 year	3 years/2 years	2 years/1 year	4 years/4 years	3 years/1 year	3-5 years/1 year	3 years/1 year
On-site service charge	N/A	Included (2 years)	N/A	\$50 (1 year)	\$25 (1 year)	Included (1 year)	Included (1 year)
24-hour turnaround for parts replacement	■	■	■	■	■	■	■

N/A—Not applicable; The product does not have this feature.

computer software and hardware, offers bare-bones PC systems as well as standard configurations.

The included Intel LANdesk Client Manager 3.1 could not monitor fan operation or voltage levels, but the unit supports Remote Wake-up. Though the case is not tool-free, there is room for expansion and no components are blocked.

The unit came with a single Pentium II/333 CPU on an Intel dual-CPU motherboard. The board also includes an integrated Adaptec dual-channel, Ultra-Wide SCSI adapter. One PCI slot has an extension for an Adaptec RAIDport card, used to enhance performance with redundant hard disks. The integrated audio subsystem with a Crystal chip set and Intel EtherEx-

press PRO 10/100-Mbps adapter went unused in favor of a Lab-way wavetable ISA sound card and a 3Com EtherLink XL 10/100-Mbps PCI Ethernet card.

The integrated AGP was bypassed in favor of a Matrox Millennium II PCI graphics card, but that did not improve performance: The TigerPro posted an average score on our High-End Winstone 98 test and below-average scores on our graphics and disk tests.

The system has a two-year-parts, one-year-labor warranty with a year of free on-site service. Toll-free technical support is available from 8 to midnight Eastern time 7 days. Performance is adequate, but management features are fairly basic.—RSA TigerDirect Inc., Miami, FL; 800-830-0056, 305-229-1119; fax, 305-

NEC PowerMate 8100	NexTrend NexStar-333	Polywell Poly 733MD2	Premio Shadowhawk LX 333	ProGen Venture Pro 350	Quantex QP6/400 SB-3x	Reason Square 6-II SE/BX	Royal Xpert SE-17	SAG STA 350
\$3,198 direct	\$2,129 direct	\$2,349 direct	\$2,800 street	\$2,049 direct	\$2,249 direct	\$2,295 direct	\$1,388 direct	\$2,550 direct
Pentium II/400	Pentium II/333	Pentium II/333	Pentium II/333	Pentium II/350	Pentium II/400	Pentium II/333	Pentium II/350	Pentium II/350
64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM
IBM DTTA-371010	IBM DHEA-38451	IBM DHEA-38451	Maxtor 88455D8	Maxtor 88400D8	IBM DCAA-34330	IBM DHEA-38451	Maxtor 88480D8	Seagate ST 39140A
10.1GB Ultra ATA-3	8.4GB Ultra ATA-3	8.4GB Ultra ATA-3	8.4GB Ultra ATA	8.4GB Ultra ATA-3	4.3GB Ultra ATA	8.4GB Ultra ATA	6.4GB Ultra ATA	9.1GB Ultra ATA-3
ATI Xpert@Work AGP	STB Velocity 128 AGP	Diamond Fire GL 1000 Pro AGP	ATI Xpert@Play AGP	Matrox Millennium II AGP	Diamond Viper V330 AGP	Matrox Millennium II PCI	WIN Fast 3D L2300 AGP	Number Nine Revolution 3D AGP
4MB SGRAM	4MB SGRAM	8MB SGRAM	8MB SGRAM	8MB WRAM	4MB SGRAM	4MB WRAM	8MB SGRAM	8MB WRAM
ATI Rage Pro	nVidia RIVA 128	3Diabs Permedia 2	ATI Rage Pro	Matrox MGA- 2164WA-B	nVidia RIVA 128	Matrox MGA- 2164W	3Diabs Permedia 2	Number Nine Ticket to Ride
NEC C700 (16.0)	CTX FX 7100 (16.0)	Sampo KM711 (16.0)	Premio H763 (15.8)	Panasonic S70 (16.0)	Amtran AT897D (16.0)	Princeton E090 (17.3)	Cybervision C70 (16.0)	Hitachi SuperScan Elite 6.30 (16.0)
512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst
Intel 440BX	Intel 440LX	SuperMicro	Premio 212B	DF	Intel	Intel	Giga-Byte	Intel
Intel 440BX	Intel 440LX	Intel 440LX	Intel 440LX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
Phoenix 4.0 Release 6.0	AMI (7/15/97)	AMI Ver. 2.5	AMI (11/25/97)	Award (11/14/97)	Phoenix 4.0 Release 6.0	Phoenix 4.0 Release 6.0	Award (2/20/98)	Phoenix (2/28/98)
32X NEC CDR- 1900A CD-ROM	32X Toshiba XM- 6202B CD-ROM	32X Toshiba XM- 6202B CD-ROM	24X Mitsumi CRM- FX240B CD-ROM	32X Sony CDU 711 CD-ROM	32X Toshiba XM- 6202B CD-ROM	32X Toshiba XM- 6202B CD-ROM	32X A Open CD- 932E CD-ROM	32X Toshiba XM- 6202B CD-ROM
None	None	Hardware	Hardware	None	None	Software	Hardware	None
N/A	N/A	3Diabs Permedia 2	ATI Xpert@Play	N/A	N/A	N/A	3Diabs Permedia 2	N/A
Integrated Crystal CS4235-jq	Creative Labs Sound Blaster AWE64 (ISA)	Yamaha OPL3 (ISA)	Creative Labs Sound Blaster AWE64 (ISA)	S3 SonicVibes Audio Accelerator (PCI)	Ensoniq AudioPCI Card (PCI)	Integrated Crystal CS4236b	Labway Yamaha Chip Set (ISA)	Integrated Crystal CS4611-CM EP
Wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	Wavetable	Wavetable	Wavetable	Wavetable
Intel EtherExpress Pro/100+ PCI	3Com Fast Etherlink XL PCI	Intel EtherExpress Pro/100+ PCI	3Com Fast Etherlink XL PCI	3Com Fast Etherlink XL PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100+ PCI
384MB	512MB	1GB	384MB	384MB	384MB	384MB	384MB	384MB
1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	3 ISA, 2 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP
3/1	3/2	6/2	3/2	3/2	4/1	3/1	3/3	2/2
0/2	0/1	0/1	0/3	0/2	0/4	0/1	0/0	0/1
230	230	300	115	235	235	235	230	235
1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
■	■	■	■	■	■	■	■	■
3 years/3 years	3 years/1 year	3 years/5 years	2-3 years/3 years	3 years/1 year	3 years/1 year	6 years/6 years	1 year/1 year	5 years/1 year
Included (1 year)	Included (1 year)	\$75 (1 year)	\$50 per year	Included (1 year)	Included (1 year)	Included (1 year)	\$129 (2 years)	\$75 (1 year)
■	■	■	■	■	■	■	■	■

228-3400; www.tigerdirect.com. Choose 544 at www.pcmag.com/infolink.

Toshiba Equium 7100S

Pentium II/350, 4.9GB hard disk, 17-inch monitor, SDRAM. High-end Win-stone 98 score: 31.9. \$2,820 street.

Toshiba America Information Systems tried hard to design an efficient and functional managed PC with its Equium 7100S, and in many respects it succeeded. The Equium's case and interior design facilitates access and removal of parts, but easy removal does not always equal an easy return back into the case. The Equium 7100 series is Toshiba's built-to-order modular corpo-

rate PC line. Major components, such as removable storage drives, are interchangeable across Equium 7100 series models.

The interior of the Equium 7100S is easy to service. A unique lockable corner panel on the left side pops off to allow quick access to system and video memory and to a lever that releases the slide-out motherboard. Two latches on the right side release the rest of the cover to provide access to the drive bays. Stickers inside offer instructions on servicing key components. However, we found that returning the motherboard to its place after removal was difficult and required much care to avoid damaging the slide mechanism. Toshiba is working to remedy this.

The Equium 7100S includes an intrusion alarm and sup-

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Managed PCs

Ends

	SIA PC/333- Pentium II Mid Tower	Sys Performance Pro 4008A	Tangent Medallion	Tiger Pro 333 NT	Toshiba Equium 7100S	Total Serengeti 333+	XI 333 MTower SP	Zenon Platinum NLX4
Price of tested configuration	\$2,939 direct	\$2,597 direct	\$1,955 direct	\$2,399 direct	\$2,820 street	\$1,970 street	\$2,249 direct	\$1,839 direct
Processor	Pentium II/333	Pentium II/400	Pentium II/333	Pentium II/333	Pentium II/350	Pentium II/333	Pentium II/333	Pentium II/333
Installed RAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM
Hard disk	Quantum Fireball SE 8.4A	IBM DHEA-38451	Fujitsu MPA304AT	Maxtor 86480D6	Western Digital Caviar AC36400	Quantum Fireball ST 3.5	IBM DHEA-38480	Maxtor 86480D6
Capacity and interface	8.4GB Ultra ATA	8.4GB Ultra ATA-3	4.3GB ATA-3	6.4GB Ultra ATA	4.9GB Ultra ATA	6.4GB Ultra ATA	6.4GB Ultra ATA-3	6.4GB Ultra ATA
Graphics adapter and interface	Diamond Viper V330 AGP	Matrox Millennium II AGP	STB Velocity 128 AGP	Matrox Millennium II PCI	Integrated AGP	Diamond Viper V330 PCI	Number Nine Revolution 3D AGP	ATI Xpert@Work AGP
Graphics memory	4MB SGRAM	8MB WRAM	4MB SGRAM	8MB WRAM	4MB SGRAM	4MB SGRAM	4MB WRAM	4MB SGRAM
Graphics chip set	nVidia RIVA 128	Matrox MGA- 2164WA-B	nVidia RIVA 128	Matrox MGA- 2164WA-B	ATI Rage Pro	nVidia RIVA 128	Number Nine Ticket to Ride	ATI Rage Pro
Monitor (measured diagonal size, in inches)	ViewSonic VPA150 (15.0)	SYS SPM-17-MS (15.9)	CTX FX7100 (15.7)	KDS VS-7 (18.0)	Toshiba TekBright 700P (18.0)	Imagic 778L (16.0)	OptiQuest V773 (18.0)	Cybervision C70 (18.0)
Installed Level 2 cache and type	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst	512K pipelined- burst
Motherboard manufacturer	Intel	Giga-Byte	Tyan	Intel	Toshiba	Asus	Supernano	BCM
Chip set	Intel 440LX	Intel 440BX	Intel 440LX	Intel 440LX	Intel 440BX	Intel 440LX	Intel 440LX	Intel 440LX
BIOS manufacturer and version (or date)	Phoenix 4.0 Release 6.0	Award (2/20/98)	AMI Ver. 2.5	Phoenix 4.0 Release 6.0	Phoenix (2/25/98)	Award 4.51PG	AMI (7/15/95)	AMI (7/5/98)
CD-ROM drive speed and model	32X Toshiba XM- 6202B CD-ROM	32X TEAC CD- 532E CD-ROM	32X Toshiba XM- 6202B CD-ROM	24X NEC CDR- 1800A CD-ROM	24X Toshiba XM- 6102B CD-ROM	32X Toshiba XM- 6202B CD-ROM	32X TEAC CD- 532E CD-ROM	24X Toshiba XM- 6102B CD-ROM
MPEG-2 support	Software	None	None	None	Hardware	Software	Software	Software
Hardware manufacturer and model	N/A	N/A	N/A	N/A	ATI 3D Rage Pro	N/A	N/A	N/A
Sound device	Integrated Yamaha OPL3	Creative Labs Sound Blaster AWE64 (ISA)	AzTech 128 Wave (PCI)	Labway OPL3-SA (ISA)	Integrated Crystal CS4236b	Creative Labs Sound Blaster AWE64 (ISA)	DCS Sound Image 32-bit Wave 5727 (PCI)	Zenon Opti 231 (ISA)
MIDI synthesis type	FM, wavetable	FM, wavetable	FM	Wavetable	Wavetable	FM, wavetable	Wavetable	FM
Network adapter	3Com Fast Etherlink XL PCI	3Com Fast Etherlink XL PCI	Intel EtherExpress Pro/100+ PCI	3Com Fast Etherlink XL PCI	Intel EtherExpress Pro/100+ PCI	Intel EtherExpress Pro/100B PCI	3Com Fast Etherlink XL PCI	3Com Fast Etherlink XL PCI
Expandability								
Maximum RAM	384MB	1GB	1GB	512MB	256MB	384MB	384MB	384MB
Expansion-bus slots	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 PCI, 1 PCI/ISA	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	3 / 2	3 / 2	2 / 3	3 / 2	1 / 1	3 / 2	3 / 2	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 3	0 / 3	0 / 3	0 / 1	0 / 1	0 / 1	0 / 2	0 / 2
Power-supply wattage	235	235	235	150	145	235	250	235
Parallel/serial ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Service and Support								
24-hour, 7-day live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	Varies/5 years	3 years/3 years	2 years/1 year	3 years/1 year	3 years/3 years	3 years/3 years	1 year/1 year
On-site service charge	N/A	Included (1 year)	N/A	Included (1 year)	Included (1 year)	\$89 (1 year)	\$49 (1 year)	\$199 (1 year)
24-hour turnaround for parts replacement	■	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.

ports Wake on LAN. Toshiba's software bundle includes Intel's LANdesk Client Manager 3.1, which supports some hardware monitoring.

Drive expansion is limited since all the drive bays are occupied; a PCI slot and a PCI/ISA shared slot are available, however. The motherboard offers a number of integrated features, including an ATI 3D Rage Pro graphics chip set with 4MB SGRAM, a wavetable synthesis audio subsystem with a Crystal CS4236 audio chip set, and two USB ports. The 350-MHz-based unit was a relatively poor performer for its processor class.

Toshiba provides 24-hour toll-free support and backs the unit

with a three-year-parts, one-year-labor warranty and a year of free on-site service.

Toshiba offers the right management capabilities, but the Equium's case design needs further refinement.—RSA

Toshiba America Information Systems Inc., Irvine, CA; 888-598-7802, 714-583-3000; fax, 800-457-7777; <http://computers.toshiba.com>. Choose 545 at www.pcmag.com/infolink.

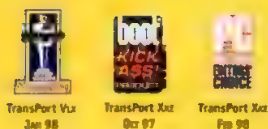
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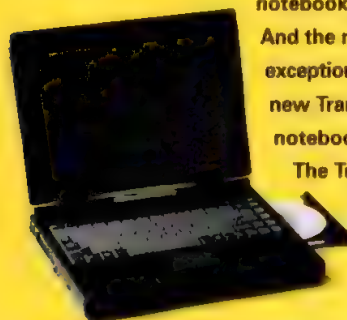
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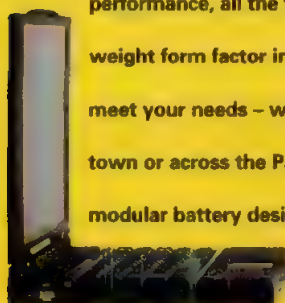


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its processor class and has an adequate level of remote manageability—all for an appealingly low price. Total Peripherals also custom-builds units for individuals and custom configures private-label PCs for resellers.

While the Serengeti 333+ doesn't offer a lockable case or an intrusion detector, the bundled copy of Intel's LANDesk Client Manager 3.1 detected all the hardware components and was able to monitor the unit for fan, voltage, and thermal alerts. The Intel EtherExpress 10/100-Mbps PCI Ethernet card can be upgraded to support Wake on LAN. The interior was uncluttered except for some minor cable tangles near the memory slots, and there was plenty of expansion room in the mid-tower case. Entry to the case was not tool-free, however.

The Serengeti 333+ comes with an Iomega 100MB Zip drive as well as a Toshiba 32X CD-ROM drive. The ASUSTek ATX motherboard includes an AGP port but was configured with an Diamond Multimedia Viper V330 PCI graphics card with 4MB of SGRAM and an nVidia RIVA 128 chip set, and a Creative Labs AWE64 wavetable ISA sound card.

The Serengeti 333+ performed admirably on our benchmark tests, logging one of the best High-End Winstone 98 scores for its Pentium II/333 CPU class; the unit's High-End Disk WinMark 98 score was above average. Other scores were average.

*The Total system includes an
Iomega Zip drive,
but it lacks Wake on
LAN support.*

Total Peripherals offers a three-year-parts, one-year-labor warranty. Technical support is available during business hours weekdays. The unit offers solid performance and a reasonable level of manageability.—RSA

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Xi 333 MTower SP

Pentium II/333, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 32.0. \$2,249 direct.

With mostly average performance, adequate desktop monitoring features, and an easily serviceable interior, the Xi 333 MTower SP, from Xi Computer Corp., is a reasonable choice as a managed corporate PC. Xi, a mail-order PC vendor that previously specialized in motherboard design, now offers high-end AutoCAD workstations as well as build-to-order single- and dual-CPU Pentium and Pentium II PCs.

The unit uses a SuperMicro ATX motherboard and comes in a lockable mid-tower case (not tool-free) that offers easy access to all key components. Expansion room is ample, with five open bays, three open ISA slots, and two available PCI slots. The system came to us with Intel LANDesk Client Manager 3.0 (Version 3.1 should be available by the time you read this), which was able to detect most hardware components and monitor the sys-

Avoid 56k commflict.



tem for thermal, fan speed, and voltage alerts. The 3Com 10/100-Mbps Ethernet card supports Remote Wake-up. Chassis intrusion detection is a \$15 option.

The Xi 333 was configured with a Number Nine Revolution 3D AGP graphics card with 4MB of WRAM and the Ticket2Ride chip set, which includes 2-D, 3-D, and MPEG2 playback technology. Also included is a US Sertek DCS Sound Image 32-bit Wave PCI wavetable sound card. The unit posted average scores across our benchmark tests.

Xi provides 24-hour, toll-free technical support and backs the unit with a three-year warranty. A year of on-site service costs \$49. The Xi 333 MTower SP offers enough desktop management features to merit consideration.—*RSA*
Xi Computer Corp., San Clemente, CA; 800-432-0486, 714-498-0858; fax, 714-492-6571; www.xicomputer.com. Choose 547 at www.pcmag.com/infolink.

Zenon Platinum NLX4

Pentium II/333, 6.4GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98 score: 28.9. \$1,839 direct.

The Zenon Platinum NLX4 mid-tower has an eye-catching price and some adequate management features. Zenon, a build-to-order PC vendor, serves the government and educational markets in addition to corporate and individual customers. The company also

The Zenon unit's motherboard slides out for easy-servicing, but the system's performance was disappointing.

offers PCs featuring AMD and Cyrix CPUs.

The Platinum's interior is easy to service thanks to the extra width of the lockable (but not tool-free) case. The "NLX" in the name is somewhat confusing. While the motherboard does indeed slide out for easy servicing, it's an ATX motherboard mounted on a slide-out panel as opposed to a true NLX board.

The system supports Remote Wake-up. Intel's LANdesk Client Manager 3.1, which monitors voltage, fan speed, and temperature, is included. Because the CPU fan was not properly connected to the motherboard, however, the unit failed to detect fan failure.

The system came with a 6.4GB Maxtor DiamondMax hard disk. It also had an ATI Xpert @Work AGP 2X graphics card with 4MB of SGRAM and ATI's Rage Pro AGP 2X chip set. Lotus SmartSuite 97 was included in the bundle. The system was a disappointing performer on our benchmark tests, however, logging mostly below-average scores.

Zenon backs the Platinum NLX4 with a one-year warranty and offers technical support six days a week during business hours. The unit has a good price, and fair although not well-implemented management features, but it is short on performance.—*RSA*
Zenon Computer Systems Inc., City of Industry, CA; 800-899-6119, 626-935-1860; fax, 626-935-1826; www.zenontech.com. Choose 548 at www.pcmag.com/infolink. **PC**

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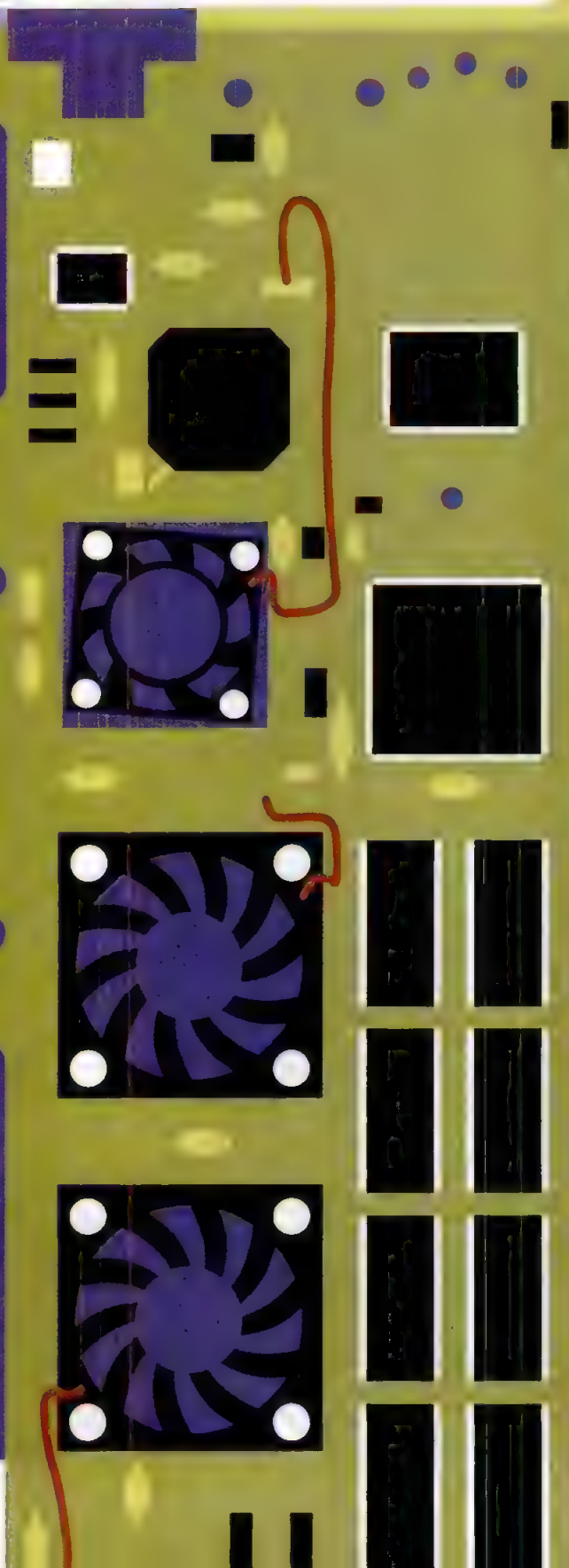
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We test nine OpenGL cards for professional 3-D graphics.

By Jon Hill

Not long ago, the words *graphics workstation* meant a Unix-based machine, most likely from Silicon Graphics or Sun, that cost tens of thousands of dollars. Today, tasks such as 3-D data visualization, design automation, and high-resolution 3-D animation can now be accomplished on a standard 300-MHz Pentium II PC—as long as you augment the CPU with a high-end graphics card to share the computational burdens inherent in 3-D rendering.



Editors' Choice

- Better choices are almost here.



Although three of the OpenGL accelerators we tested are good choices, none of them is the ideal choice. And with new, faster chip sets arriving as you read this,

our advice to serious professionals is to wait.

As we found in lab testing of the reference designs from chip makers Evans & Sutherland and 3Dlabs, the accelerators that are about to appear outshine currently available designs in most 3-D chores, sometimes by a wide margin (see the sidebar "Clash of the 3-D Titans"). New offerings from AccelGraphics, Intergraph, Leadtek, Omnicomp, Symmetric, and others will employ the 3Dlabs GMX chip set, while AccelGraphics, Diamond, and others will migrate to the new Evans & Sutherland chip sets. You'll pay a premium of \$500 to \$1,000 for the new technologies, but if you want to get years of use out of your new PC workstation, the investment is

a wise one.

Still, three of the current products we tested proved good or even excellent for use on several typical 3-D tasks, and they merit honorable mention. The AccelEclipse II (\$2,000 street) and Diamond Fire GL 4000 (\$2,400 street), both based around the current Mitsubishi/E&S chip set, were excellent performers on our modeling and simulation tests and good performers for CAD and animation. Their one weak spot: below-par 2-D performance. The Intergraph Intense 3D Pro 2200S (\$1,590 street), which uses the company's own RealZm chip, was a more even performer, delivering respectable CAD results, acceptable animation and simulation/modeling speed, and fine 2-D acceleration.

REVIEW CRITERIA

PC Labs tested six current high-end 3-D graphics accelerators (costing from \$1,300 to \$2,400) aimed at CAD, animation, data visualization, and 3-D modeling professionals. Since users of such applications would likely be working on 21-inch monitors, the cards had to support 1,280-by-1,024 resolution at 32-bit true-color depth at a refresh rate of 72 Hz or better and deliver at least a 24-bit Z-buffer. (Z-buffering is a method of keeping track of surfaces that are not in view in a 3-D scene, and hence may not need not be drawn, by tracking the depth, or z value, of each triangle's vertices on a x,y coordinate plane.) The cards also had to support the OpenGL application programming interface, the standard API used by most professional CAD, animation, and modeling packages.

We also tested two OpenGL reference cards from 3-D chip makers Evans &

Sutherland and 3Dlabs. These designs, not quite final at test time, will spawn the next-generation add-in accelerators that will begin to ship as you read this and are a good indicator of the performance improvements to come (see the sidebar "The

www.pomag.com

Visit our Web site for additional test results and more information on all of the high-end cards we tested.

Newest Chips: Should You Wait?"). In addition, we also tested a dedicated Wintel midrange workstation, the HP Kayak XW (\$11,800 street for our tested configuration), to show how a

midrange workstation compares with a standard PC with a high-end OpenGL card (see "HP Kayak XW: Stepping Up to a Workstation").

HIGH-END CARD, LOW-END WORKSTATION

To be sure, *high-end* is a relative term. To a mainstream PC user with a \$100-to-\$200 graphics accelerator in his PC, high-end is a \$500 card. To a CAD professional, a \$10,000 PC with one of the \$1,400-to-\$2,000 add-in graphics cards we tested is

decidedly low-end. For our purposes, a high-end graphics accelerator is powerful enough to use professional 3-D applications on a low-end PC workstation for tasks such as these:

- **CAD/CAM** (Computer Aided Design/Computer Aided Manufacturing). From cars and airliners to soapboxes and skyscrapers, 3-D objects are designed and modeled entirely on the workstation, using applications such as I-DEAS, Pro/Engineer (which we included in our test suite), and SolidWorks. With a 3-D accelerator, a product designer can draft an object and see a detailed rendering of it from all angles, or an architect and client can walk through a virtual model of a building interior.

- **3-D animation.** If designing widgets at a CAD station doesn't float your boat, perhaps dinosaurs, space monsters, and yes, large, doomed passenger steamships will. 3-D animation is the rage for advertising, CD-ROM and game-console titles, VRML programmers, and of course, the movie industry. Whereas *Jurassic Park* and other films several years ago were created on Silicon Graphics workstations, *Titanic's* special effects were prerendered on Alpha-based Windows NT workstations using Lightwave 3D and Dynamic Oxygen 402 accelerators. Animation destined for the big screen is almost always rendered in time-consuming software as a final step, but to develop complex scenes, hardware accelerators that can come close to software quality in real time are a necessity. Applications that lend themselves to film and video animation include SoftImage and 3D Studio Max, which along with Lightwave 3D, make up part of our animation test suite.

- **Modeling and simulation.** The scientific

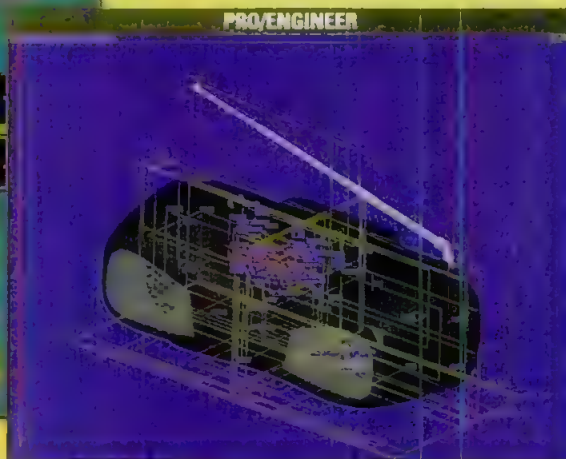
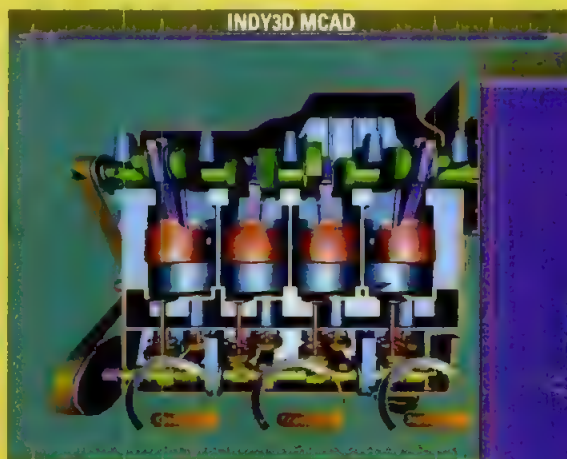
IN THIS REVIEW

AccelEclipse II	198
Diamond Fire GL 4000	202
Dynamic Oxygen 402	202
ELSA GLoria-XL	206
Intergraph Intense 3D Pro 2200S	206
Omnicomp 3Demon MX16/16	206
The Newest Chips: Should You Wait?	194
HP Kayak XW: Stepping Up to a Workstation	195
Performance Tests	198
Summary of Features	204

3-D Tasks: Typical Chores for OpenGL

Today's powerful OpenGL accelerators let relatively inexpensive Intel-based PCs perform many of the same tasks as workstations costing tens of thousands of dollars

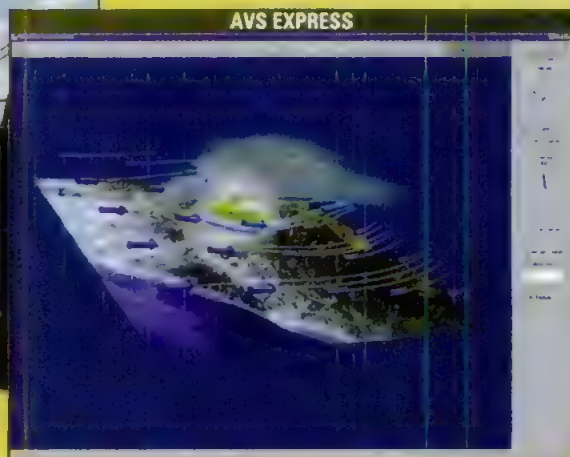
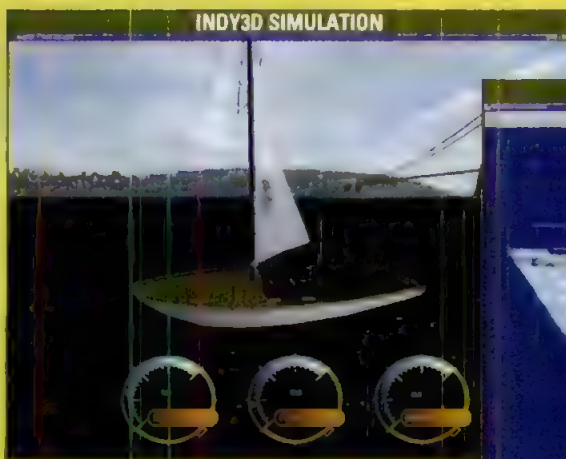
CAD/CAM engineers and architects use OpenGL accelerators for everything from high-end product drafting to rendering walk-throughs for architectural designs. Better cards can handle the complex geometry involved in rendering detailed, shapely objects, and accurate Z-buffering and realistic lighting are a must.



Animation is an important task for advertising professionals, moviemakers, and game developers. To do it well, a card has to be able to handle high polygon counts and deliver accurate, detailed textures in a moving scene. Atmospheric effects such as lighting and fog are important, as is the general visual quality of scenes.

Modeling and simulation are important to the scientific community for tasks such as molecular and weather modeling and medical imaging. Better cards will leave the CPU plenty of headroom to perform complex calculations and render scenes quickly to allow real-time interaction with the models.

2-D Windows performance (not shown) is important for everyday tasks such as word processing and image editing. Better OpenGL cards will deliver 2-D Windows GUI acceleration at least on a par with a typical mainstream 2-D-only card.



The Newest Chips: Should You Wait?

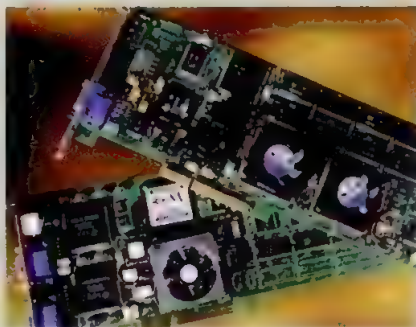
Although the cards reviewed in this roundup are some of the fastest available today, the two titans of the Wintel 3-D chip set universe, Evans & Sutherland and 3Dlabs, are both about to release newer, more powerful versions of their graphics accelerators: the E&S REALImage 2000 and the 3Dlabs GMX (consisting of the Glint chip with the Gamma coprocessor). To gauge how much faster these cards will be, we obtained and tested prototype cards from the companies. If the preliminary results are any guide, the new hardware will be worth the wait.

On our 300-MHz test-bed, during the geometry-intensive Indy3D MCAD test, for example, the rate of the 3Dlabs reference card jumped to 7.7 frames per second (fps), as compared with 4.4 fps for the Omnicomp 3Demon MX16/16, which employs the older Glint MX.

The E&S reference card improved on the REALImage 1000-equipped Diamond Fire GL 4000 only slightly—from 5.1 to 5.8 fps—in our 300-MHz machine. But on a 400-MHz Pentium II, the E&S reference accelerator improved to 7.4 fps, leveraging a good deal of the processor boost (the 3Dlabs card improved only by about 1 percent in the faster machine). This result indicates that the E&S accelerator could outperform 3Dlabs on a dual-processor 400-MHz Pentium II system.

UNDER THE HOOD

Both chip companies take vastly different approaches to clearing the hurdles presented by 3-D rendering. Understanding the strengths of each requires a glimpse inside the 3-D pipeline. Application developers create 3-D worlds by subdividing images into triangles (also referred to as polygons), which are more readily manipulated by the computer than other shapes. At a high level, displaying the triangles is a two-step process of geometry and rasterization (rendering).



Cards with the new 3Dlabs (top) and E&S chip sets are worth waiting for.

In general, the 3-D design software on the host computer performs all geometry calculations, which involves assembling all displayed triangles, sorting them from front to back, and determining their shading and texture characteristics as well as atmospheric effects such as fog. Then the program hands this information to the 3-D rendering card to generate the pixels.

3DLABS' GEOMETRY PROCESSOR

Breaking this model is 3Dlabs' new

GMX chip set, which is built around the Glint Gamma processor. The Gamma is the first dedicated graphics engine capable of performing geometry and lighting calculations itself, thus off-loading them from the host PC's processor. The geometry stage is the most important bottleneck in the 3-D pipeline, and dedicated geometry silicon is the best way to improve system performance.

For texture-intensive tasks, the Gamma can support up to eight Glint MX rendering chips, though 3Dlabs claims that the optimal configuration is only two, as on our GMX reference card.

REALIMAGE 2000

In the Windows NT workstation market, E&S's traditional strengths lie in its rendering ability. This is largely due to the company's use of 3DRAM REALImage chips, which off-load critical texture-related calculations (such as blends and adds) to 3DRAM. Because of this, REALImage-based chip sets can deliver very high performance during texture-related operations, which tend to slow down other designs. REALImage chips rely on the host CPU for all geometry, however.

The REALImage 2000 does address two weaknesses of

the REALImage 1000: It boosts maximum resolution to 1,920-by-1,200 and speeds 2-D performance significantly, as reflected in its vastly improved ZD WinBench scores.—Jan Ozer

	Indy3D	300-MHz PC		400-MHz PC	
		MCAD	Animation	Simulation	
Evans & Sutherland REALImage 2000	5.8 7.4		10.9 12.2	13.2 14.7	
3Dlabs GMX 2000	7.7 7.8		10.3 10.5	9.8 9.9	
		BETTER ►	BETTER ►	BETTER ►	

community relies on 3-D accelerators to deliver accurate real-time rendering of everything from complex weather systems to wind-tunnel analysis. Molecular models and gene mapping for chemists and biochemists are also target uses for visualization and simulation applications such as AVS/Express.

So does a high-end card make sense for you? If you have to ask this question, the

answer is probably no. Most PC users don't need such 3-D performance. Users who visit or plan to visit the online 3-D worlds created in VRML will see some performance benefit from an OpenGL-capable accelerator, but a \$200 card with a good OpenGL driver will do the trick, too. In their current state, VRML browsers are fairly restricted in terms of model complexity, requiring careful use of textures so

as not to overwhelm dial-up connections or the large numbers of users who do not have access to a decent 3-D accelerators for playback. For VRML viewing, all of the cards we test here are overkill.

The competition for the accelerators we reviewed comes from midrange Intel-based or Unix workstations. Whereas the cost of entry was once \$20,000 for a barebones Unix box, now architecture firms,

HP Kayak XW: Stepping Up to a Workstation

The add-in cards in this roundup let you turn your PC into a low-end 3-D graphics workstation. But if you need a midrange machine for more intense 3-D work, consider one of the higher-powered x86-based Windows NT workstations. Good choices are available from Compaq, IBM, Intergraph, and others; we tested the HP Kayak XW (\$11,800 street).

The HP Visualize fx4 OpenGL accelerator (married to 128MB of SDRAM) inside the Kayak XW we tested is a clear cut above the stand-alone cards we reviewed. With dual PA7300LC-based geometry accelerators to perform transformation, lighting, and setup calculations, plus dual custom rasterizer ASICs, the fx4 card performed some tasks at three times the rate of the accelerators in this roundup.

On the Indy3D test, for example, the fastest MCAD performer currently on the market, the Diamond Fire GL 4000, was able to maintain a rate of 5.1



The HP Kayak XW midrange workstation is a clear cut above the add-in OpenGL accelerators we tested.

frames per second. In a single-processor 300-MHz machine, the Kayak fx4 accelerator churned through the test at 15.3 fps. On our 3D Studio Max tests, the Kayak was consistently twice as fast as the standalone cards. New multithreaded drivers, released after

we completed our testing, should increase this performance gap by taking advantage of multiple CPUs on all immediate-mode applications.

The picture wasn't uniformly bright. The Kayak lagged slightly behind the top-ranked Intergraph Intense 3D Pro 2200S accelerator on our SoftImage tests, but at its weakest points the Kayak compares well with the best of the shipping—or even next-generation—products we reviewed. Its closest competitors are midrange Unix-based workstations from SGI and Sun, which generally cost thousands of dollars more. The Kayak is a notable entry into Windows NT-based OpenGL workstations, and it is one of the first Intel-based systems that can compete directly with midrange Unix workstations.—JH

HP Kayak XW. Hewlett-Packard Co., Palo Alto, CA; 800-322-4772; www.hp.com/go/kayak. Choose 506 at www.pcmag.com/infolink.

engineering outfits, manufacturers, advertising agencies, and many other professionals can equip more of their workforce with powerful, 3-D-capable hardware for \$4,000 to \$5,000.

OPENGL: THE LINGUA FRANCA

Although OpenGL was originally developed as Silicon Graphics' proprietary, Unix-based graphics library (called IRIS GL), in its current form OpenGL is a true open standard, managed and maintained by a consortium of hardware and software vendors. Silicon Graphics has aggressively pushed OpenGL onto the Windows NT desktop, and as we go to press OpenGL, Version 1.2, is being ratified by the OpenGL Architecture Review Board.

Most PC users have heard of only Microsoft's Direct3D, the other 3-D API. Although Microsoft has put a lot of time and money into Direct3D, the software has hardly any applications support other

than Windows 95 games. That should change later this year as mainstream business applications (such as 3-D spreadsheets and 3-D presentation packages) appear and take advantage of the growing installed base of inexpensive graphics cards that are able to accelerate Direct3D functions. Still, OpenGL remains firmly entrenched at the high end, because the API and the associated hardware are more robust than Direct3D and allow more complex and realistic rendering of scenes and objects.

Eventually, Direct3D and OpenGL will merge under a single, unified API. The Fahrenheit initiative, announced by Microsoft and Silicon Graphics last year, promises to provide a single API that both high-end and low-end developers can use.

COMPARING THE CARDS

We looked at high-end graphics cards based on four different chip sets. Each has

particular strengths and weaknesses. The AccelEclipse II and the Diamond Fire GL 4000 are based on Evans & Sutherland's REALimage 1000 chip set. The E&S chip set is particularly adept at addressing large textures and applying 3-D effects, such as alpha blends and transparency. The chip set does not handle 2-D objects very well, however, and it lacks a geometry setup engine. Fast-moving scenes with high polygon counts tend to bog the E&S-based products down, but the E&S cards do very well with animation and simulation.

The ELSA GLoria-XL and the Omnicomp 3Demon MX16/16 use 3Dlabs' Glint DMX chip set. In contrast with the E&S-based products, these cards contain a dedicated triangle setup engine to help speed processing of geometrically complex scenes. The Glint cards have lower fill rates than the E&S products, but they are well-suited for interactive game development.

The Intergraph Intense 3D Pro 2200S is the low end of Intergraph's product line. Good driver optimization, excellent 2-D performance, and high-quality components

Our Contributors: JON HILL is a frequent contributor to *PC Magazine*. JAN OZER is a contributing editor of *PC Magazine*. S. JAE YANG was the project leader, and JAMIE M. BSALES was the senior associate editor in charge of this story.

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PERFORMANCE TESTS

High-End Graphics Cards



The AccelEclipse II and Intergraph Intense 3D Pro 2200S led the pack of OpenGL cards, but they were clearly outclassed by the HP Visualize fx4 and the next-generation reference cards from Evans & Sutherland and 3Dlabs.

Sense8's **Indy3D, Version 2.2**, is an application-simulating benchmark test suite that measures the OpenGL graphics subsystem's performance in three scenarios—MCAD, Animation, and Simulation. The **MCAD** test contains scenes consisting of 42,000 smooth-shaded polygons. The **Animation** test scene consists of 133,000 polygons covered with 2.72MB of texture. As the viewpoint moves through the Animation scene, there is much *culling* (removal of unseen polygons) and *clipping* (of partially obscured polygons), which the application and the geometry stage of the 3-D pipeline must handle accurately. The

Simulation test exercises the cards with 8,000 polygons and 3.64MB of texture.

Although all of the cards displayed similar agility in rendering the medium-complexity MCAD model with dual-sided polygons, the performance gap widened with the Animation test (which includes large texture data) and the Simulation test (which emulates a simulation graphically). The Simulation test is more texture-intensive and has a larger average polygon size than the other two tests; it therefore rewards cards with faster pixel renderers.

The quality of 3-D output is as important as performance measures, such as the frames per second or time to complete certain operations. We used Indy3D's quality tests to supplement our visual inspection of application output. We used driver optimizations for particular applications if available. This permits OpenGL boards to enable or disable various output-quality features for specific applications. Enabling fewer quality features can yield higher frame rates, but we did not find substantially higher performance at the expense of noticeably poorer output quality in any of the tested products. We did note some minor quality tradeoffs, such as the use of 16-bit texels in the AccelEclipse II board, which improves performance slightly on heavily textured scenes but adds banding to the textures.

	Indy3D			Lightwave 3D
	MCAD	Animation	Simulation	2-D and 3-D
■ 300-MHz PC ■ 400-MHz PC Bold type denotes first place among products reviewed. Frames per second				
AccelEclipse II (PCI)	4.9 6.2	9.5 11.1	12.0 13.2	N/A ¹ N/A ¹
AccelEclipse II (AGP)	4.9 6.2	9.2 10.9	11.8 13.0	N/A ¹ N/A ¹
Diamond Fire GL 4000 (PCI)	5.1 6.3	8.9 10.2	10.3 10.7	N/A ¹ N/A ¹
Dynamic Oxygen 402 (PCI)	3.4 3.6	1.5 1.5	0.6 0.6	2.3 2.9
ELSA GLoria-XL (PCI)	3.9 4.1	4.3 4.5	4.2 4.3	4.5 N/A ²
Intergraph Intense 3D Pro 2200S (PCI)	4.7 5.5	3.5 3.8	3.9 4.0	3.8 4.5
Omnicom 3Demon MX16/16 (PCI)	4.4 4.5	4.9 5.2	4.8 5.1	4.4 5.8
HP Kayak XW*	15.3 17.7	15.7 17.1	16.0 17.5	4.2 6.0
Evans & Sutherland REALimage 2000 (AGP)*	5.8 7.4	10.9 12.2	13.2 14.7	N/A ¹ N/A ¹
3Dlabs GMX 2000 (AGP)*	7.7 7.8	10.3 10.5	9.8 9.9	6.0 8.0
	BETTER ►	BETTER ►	BETTER ►	BETTER ►

* Reported for comparison. See the sidebars "HP Kayak XW: Stepping Up to a Workstation" and "The Newest Chips: Should You Wait?" N/A¹—Not applicable. The card could not complete this task in 5 minutes.

make it an excellent all-around choice.

The Dynamic Oxygen 402 is the company's top-performing 3-D accelerator. Its four separate chips are organized in parallel: The design does especially well on large textures. A multithreaded driver dubbed *Power Threads* can take advantage of multiple CPUs, parsing tasks among the four Oxygen chips.

As you would expect, the next-generation accelerators based on the new chip sets

from E&S and 3Dlabs generally deliver impressive performance gains over current cards. The bottom line: You have to match the accelerator you buy carefully with the applications you plan to use. A CAD-oriented accelerator will disappoint a 3-D animator and vice versa. The reviews and application-specific performance tests that follow should help you find the right fit and decide whether you need the better performance promised by the next wave.

AccelEclipse II

The AccelEclipse II (\$2,000 street) is an above-average performer for most 3-D modeling, simulation, and CAD chores on the PC. Its Evans & Sutherland REALimage 1000 chip set does not incorporate a geometry engine, however, so the card bogs down on fast-moving scenes with high polygon counts. Also, 2-D performance was mediocre, and working in

The best performers were the AccelEclipse II and the Diamond Fire GL 4000, which were based on the Evans & Sutherland REALimage 1000 chip. Note that technology from Mitsubishi is used in these two cards, and that Mitsubishi has partly funded the development of the Indy3D suite. Still, most industry observers agree that Indy3D is a valid, unbiased testing tool, especially when used in concert with other tests as we have done here.

Lightwave 3D is a 3-D animation program for producing special effects for film and games. We used four scenes of varying complexity. The **2-D and 3-D** test scene renders 3-D objects consisting of 3,700 polygons in front of a 2-D bitmap backdrop. The **Texture MIP-Mapping** test renders several large surfaces with large 512- by 512-pixel textures and exercises trilinear MIP mapping operations of the card. The **4,000 Polygons** test includes many Gouraud-shaded moving objects, which stress the card's shading and fill-rate abilities. The **57,000 Polygons** test is a complex 3-D animation that stresses the geometry processing, using either the host CPU or the card's geometry engine (if present).

On the Texture MIP Mapping test, the cards from Omnicomp, ELSA, and Intergraph displayed their superiority in trilinear filtering speed. The cards from AccelGraphics and Diamond and the reference card from Evans & Sutherland failed to complete the 2-D and 3-D test within a reasonable amount of time. The 3DLabs reference card, with its high-speed Glint GMX geometry processor, was the clear winner on the geometry-intensive 57,000 Polygons test.

Kinetix's **3D Studio Max** is a 3-D modeling and animation package

popular among professionals involved in film and video production, game development, and interactive content authoring. **Benchmark 1** tests raw polygon throughput for a simple scene. **Benchmark 4** stresses geometry processing, with over 100,000 triangles in the scene, much movement, and much clipping and culling. The 3DLabs reference card performed outstandingly well here. **Benchmark 5** is similar to Benchmark 4 in terms of complexity but with fewer objects moving, thus rewarding pixel-rendering speed. **Benchmark 6** tests raw throughput of texture bitmap transfers from memory, with no MIP mapping involved, using a 20,000-polygon textured object. **Benchmark 7** uses a 12,400-polygon scene that stresses texturing and clipping.

On most 3D Studio Max tests, the cards from AccelGraphics and Diamond generally outperformed the rest of the field. The Intergraph card trailed the leaders closely on all tests except Benchmark 7, where texture mapping is heavily exercised.

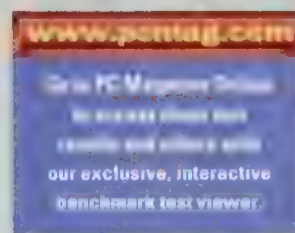
SoftImage 3D (Version 3.7) is a high-end 3-D animation package for studio-quality work. For testing, we used a scene with a 2-D bitmap texture that was scaled and applied to a large surface, thus stressing 2-D bit-blitting as well as 3-D processing. All of the cards performed similarly at a low resolution with a small polygon size. But when rendering at a higher resolution, the Intergraph entry and the 3DLabs DMX-based cards from Omnicomp and ELSA showed superior performance.

Parametric Technology's **Pro/Engineer** test is a good indicator of an OpenGL card's effectiveness in a 2-D/3-D MCAD setting. The test consists of medium-complexity objects and rewards cards that have fast rendering engines. Here, cards from Diamond and AccelGraphics were the winners.

AVS/Express is a 3-D data visualization and analysis program. Using this program, we ran a test that renders a 3-D weather model of textured terrain with four different levels of textures: no texture, 2-D land-surface texture, multiple-layered alpha textures to simulate 3-D cloud formation, and a combination of all of these 2-D and 3-D textures. The test helps us observe how a card's performance scales against a rising texture load. The Diamond and AccelGraphics cards were the best performers at all levels of texture loads, widening their margin over other contenders as more textures were applied.

Finally, since users won't spend all their time in such specialized 3-D applications, we used both business and high-end versions of our **Winstone** and **Graphics WinMark 98** tests to evaluate the cards' performance in running typical business and high-end 2-D applications, such as Microsoft Word, Excel, Adobe Photoshop, and more.

We also solicited SolidWorks for a test program using that company's 3-D solid-modeling software, but we could not establish a test script by press time.—*Analysis written by S. Jae Yang*



Texture MIP Mapping	4,000 Polygons	57,000 Polygons
0.6	6.4	0.7
0.7	8.8	0.9
0.6	6.5	0.7
0.8	8.9	0.9
0.2	6.3	0.7
0.3	8.6	0.9
0.4	2.6	0.7
0.5	3.6	0.9
1.6	6.3	0.7
N/A ²	N/A ²	N/A ²
1.3	4.8	0.7
1.5	5.5	0.9
1.6	6.8	0.7
2.0	9.1	1.0
2.0	14.3	1.1
3.0	17.9	1.3
1.7	6.3	0.7
2.2	8.8	0.9
1.5	17.9	1.2
1.8	23.8	1.5

N/A²—Not applicable. The card was not compatible with this application on our 400-MHz test-bed.

Photoshop or productivity applications between 3-D jobs will be noticeably slower. Still, the card is a solid choice, especially if you can find it at a discount.

AccelGraphics provides a host of application optimization settings in the driver. A check box that was supposed to enable or disable 32-bit texels apparently had no effect, though, rendering all texels in 16-bit mode.

On labs tests, we found the card's per-

formance closely tied to CPU speed. On our Indy3D and Lightwave 3D tests, for example, the card's performance rose more

SUITABILITY TO TASK

AccelEclipse II

CAD/CAM	Good
Animation	Good
Modeling and simulation	Excellent
2-D Windows	Fair

than 25 percent when we moved from a 300-MHz Pentium to a 400-MHz machine; other accelerators showed more modest improvement. Frame

rates on AVS/Express, a simulation package, were up to three times as fast as that of the other cards in the roundup, and the card also did very well on our Pro/Engineer and 3D Studio Max tests. The AccelEclipse did not perform very well on our Lightwave 3D or SoftImage tests.

Expect price drops in the coming months as stiffer competition in the form of new GMX-based cards from 3DLabs, as well as next-generation REALimage

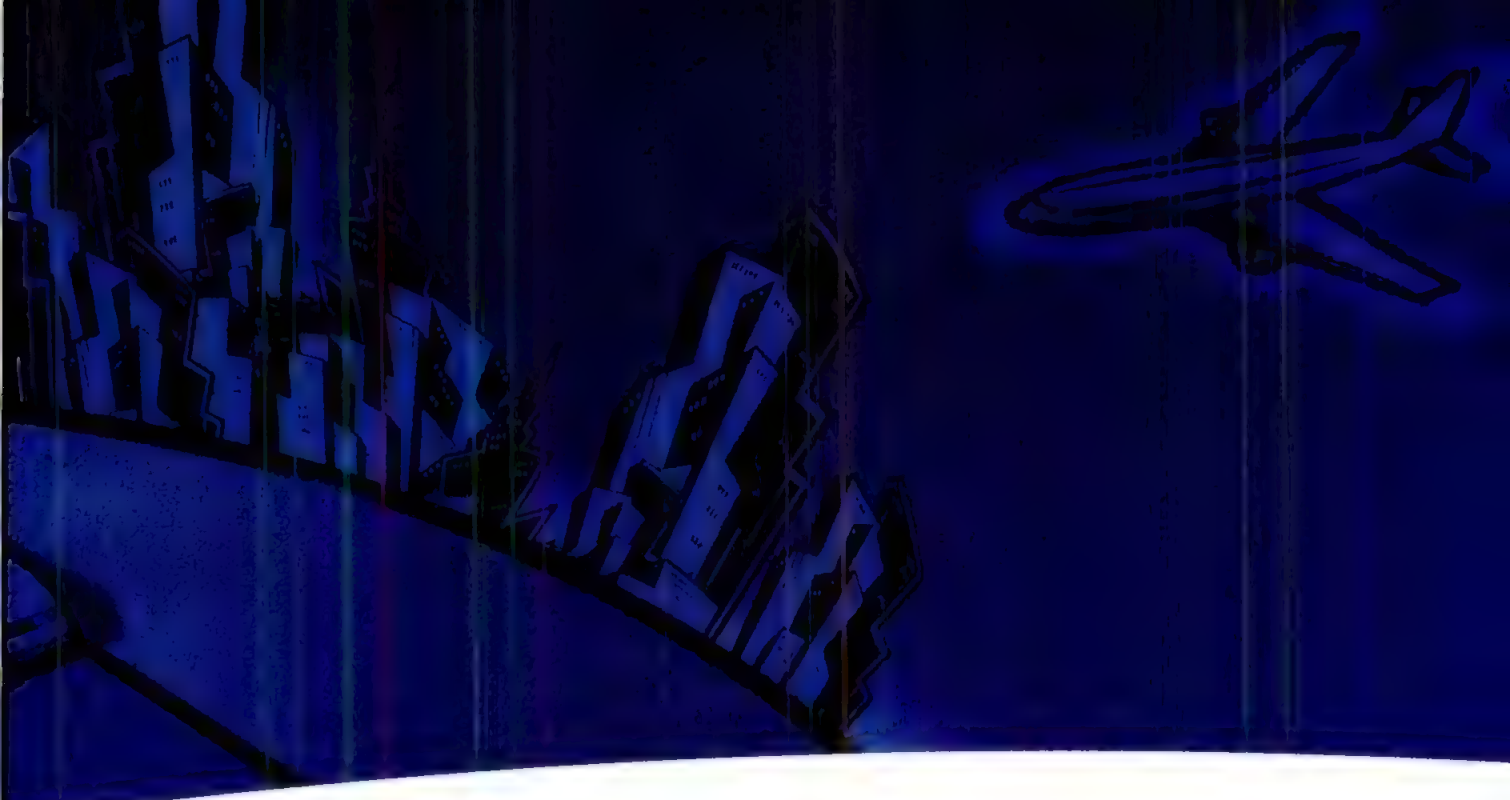


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3Dfx Reality 330 4MB (\$184) - N/S	

*Estimated Street Prices accurate at time of printing. All tests conducted by Matrox Graphics Inc. using a Dell Pentium II 300MHz with 64MB of RAM and 512K cache. Matrox Productiva G100 was tested with 8MB of memory using driver revision 3.82. ATI XPERT Work AGP was tested with 8MB of memory using driver revision 4.0.0.0.2276. Diamond Viper V330 was tested with 4MB of memory using driver revision 4.0.0.0.2276. 3Dfx Reality 330 was tested with 4MB of memory using driver revision 4.0.0.0.2276. WinBench 98 Business tests conducted at 1280x1024@75Hz at 75Hz refresh using small fonts under Windows 95. D3D2.

matrox

PERFORMANCE TESTS

Our Test-Bed We installed each OpenGL accelerator in an NEC Direction SPL 300, a 300-MHz Pentium II-based machine with an Ultra-ATA hard disk, running Windows NT 4.0 with Service Pack 3. We repeated the Lightwave 3D and Indy3D tests on an NEC Direction SPB 400 with a 400-MHz Pentium II processor to explore scalability. Both test-beds were

equipped with 512K of L2 cache per CPU and 128MB of RAM. We tested all cards with the bundled installable client driver (ICD), with the display set to 1,280-by-1,024 resolution with 32-bit true color and a 75-Hz vertical refresh rate. We selected the driver presets for a specific application when available; otherwise, we used default settings.

▲ High scores are best. ▼ Low scores are best.

Bold type denotes first place among products reviewed.

	3D Studio Max ▲						SoftImage ▼	Pro/Enginee
	Benchmark 1 (frames/sec)	Benchmark 4 (frames/sec)	Benchmark 5 (frames/sec)	Benchmark 6 (frames/sec)	Benchmark 7 (frames/sec)		1,024 x 768 (min:sec)	(min:sec)
AccelEclipse II (PCI)	12.5	7.1	14.3	16.7	8.8		2:22	2:44
AccelEclipse II (AGP)	12.5	7.1	14.3	20.0	9.1		2:16	2:44
Diamond Fire GL 4000 (PCI)	12.5	7.1	14.3	20.0	8.8		2:06	2:43
Dynamic Oxygen 402 (PCI)	12.5	6.7	7.7	12.5	4.8		1:43	3:26
ELSA GLoria-XL (PCI)	7.1	5.0	7.7	9.1	5.2		1:22	4:31
Intergraph Intense 3D Pro 2200S (PCI)	12.5	7.1	12.5	16.7	6.1		0:59	3:02
Omnicom 3Demon MX16/16 (PCI)	8.3	5.6	8.3	10.0	5.7		1:17	4:10
HP Kayak XW*	25.0	12.5	16.7	20.0	12.0		1:04	2:35
Evans & Sutherland REALImage 2000 (AGP)*	12.5	7.1	14.3	16.7	9.1		1:29	2:59
3Dlabs GMX 2000 (AGP)*	16.7	33.3	14.3	14.3	9.4		1:33	2:55

* Reported for comparison

▲ High scores are best.

Bold type denotes first place among products reviewed.

	AVS/Express ▲				2-D Windows Acceleration ▲			
	No Texture (frames/sec)	2-D Texture (frames/sec)	2-D and 3-D (frames/sec)	Layered Alpha Texture (frames/sec)	ZD Business Winstone 98	ZD Business Gra- phics WinMark 98	ZD High-End Winstone	ZD High-End Gra- phics WinMark
AccelEclipse II (PCI)	51.9	46.6	8.8	9.0	22.3	59.4	24.4	91.3
AccelEclipse II (AGP)	52.2	46.8	8.8	9.0	22.7	62.0	25.2	93.4
Diamond Fire GL 4000 (PCI)	53.0	47.9	8.9	9.0	22.4	59.0	24.8	92.2
Dynamic Oxygen 402 (PCI)	39.3	10.1	0.9	1.0	22.3	51.8	25.9	81.7
ELSA GLoria-XL (PCI)	36.8	22.3	2.8	3.0	26.0	95.9	30.0	112.0
Intergraph Intense 3D Pro 2200S (PCI)	49.8	11.5	2.9	3.4	26.5	97.4	31.3	149.0
Omnicom 3Demon MX16/16 (PCI)	34.5	21.3	2.7	2.9	27.0	110.0	30.6	136.0
HP Kayak XW*	75.1	72.2	10.7	10.7	25.7	83.7	31.8	112.0
Evans & Sutherland REALImage 2000 (AGP)*	37.5	37.4	12.5	12.5	26.7	102.0	28.5	116.0
3Dlabs GMX 2000 (AGP)*	89.4	52.3	5.8	6.0	17.4	44.8	25.8	84.6

* Reported for comparison

2000-based cards from Evans & Sutherland, begin to ship in quantity. For a low-end CAD, animation, or modeling workstation, however, the current AccelEclipse should suit you just fine.—*Jon Hill*

AccelEclipse II. Street price: \$2,000. AccelGraphics Inc., Milpitas, CA; 800-444-5699; www.ag3d.com. Choose 500 at www.pcmag.com/infolink.

Diamond Fire GL 4000

The Diamond Fire GL 4000 (\$2,400 street) excelled on CAD and modeling/simulation tests and performed animation well. Negative qualities include a relatively low maximum display resolution of 1,280-by-1,024 (a consideration for big-screen users) and disappointing 2-D benchmark test scores.

The GL 4000 is configured with Mitsubishi's 3DPro/2mp 3-D rendering chip, which is based on Evans & Sutherland's REALImage technology. This chip set's memory architecture performs calculations associated with anti-

aliasing, blending, and Z-buffer operations, all in local 3DRAM without input from the graphics processor, streamlining these functions.

The GL 4000 proved a solid choice for CAD work, placing first in the Indy3D MCAD and Pro/Engineer tests (along with the AccelEclipse II, which is based on the same chip set). The GL 4000 excelled on several animation tests, but it showed poor results on the Lightwave 3D Texture MIP Mapping test. It was also unable to complete the Lightwave 3D 2-D and 3-D test in the allotted time. The GL 4000 excelled on simulation tests, placing first on all AVS/Express tests and third on the Indy3D Simulation test. The card rated well below aver-

age on ZD WinBench tests, however.

Still, given its generally high scores on most of our application tests, the GL 4000 is a solid choice if you don't need extremely wide-screen or very fast 2-D perfor-

mance.—*Jan Ozer*

Diamond Fire GL 4000. Street price: \$2,400. Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846; www.diamondmm.com. Choose 501 at www.pcmag.com/infolink.

Dynamic Oxygen 402

The Dynamic Oxygen 402 (\$2,299 list) performed fairly well on our SoftImage and 3D Studio Max animation tasks, but the card's performance was a disappointment on the bulk of our tests. The company's new Power Threads drivers, which were not ready in time for testing, may improve some of the shortcomings we found.

Installing the Oxygen 402 under Windows NT 4.0 was a breeze, but when we

ran a set of quality checks using Indy3D, the card failed a number of important tests, such as trilinear MIP mapping and depth sorting. The card's anti-aliasing implementation was meager, and it had problems with the perspective-

SUITABILITY TO TASK

Diamond Fire GL 4000

CAD/CAM	Good
Animation	Fair
Modeling and simulation	Excellent
2-D Windows	Fair

SUITABILITY TO TASK

Dynamic Oxygen 402

CAD/CAM	Fair
Animation	Poor
Modeling and simulation	Poor
2-D Windows	Fair

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SUMMARY OF FEATURES

OpenGL Accelerators

■ YES ■ NO	AccelEclipse II	Diamond Fire GL 4000	Dynamic Oxygen 402	ELSA GLoria-XL	Intergraph Intense 3D Pro 2200S	Omnicom 3Demon MX16/16
Price of tested configuration	\$2,000 (street)	\$2,400 (street)	\$2,299 (list)	\$1,650 (street)	\$1,390 (street)	\$1,300 (street)
Frame buffer memory amount and type (tested configuration)	15MB 3DRAM	15MB 3DRAM	32MB SDRAM	16MB VRAM	16MB SDRAM	16MB VRAM
Texture memory (tested/maximum)	CDRAM (16MB / 16MB)	CDRAM (16MB / 16MB)	Combined with frame buffer	EDO RAM (24MB / 40MB)	SDRAM (16MB / 16MB)	EDO DRAM (16MB / 32MB)
Z-buffer memory (tested/maximum)	Combined with frame buffer	Combined with frame buffer	Combined with frame buffer	Combined with frame buffer	Combined with frame buffer	EDO DRAM (16MB / 32MB)
3-D rendering chip	Evans & Sutherland REALimage 1000	Evans & Sutherland REALimage 1000	Dynamic Pictures Oxygen	3Dlabs Glint MX	Intergraph Realizm II	3Dlabs Glint MX
Geometry processor chip	None	None	None	3Dlabs Delta	Integrated	3Dlabs Delta
2-D graphics accelerator chip	Integrated	Integrated	Integrated	Integrated	Integrated	S3 Trio64V+
Maximum number of colors/refresh rate at:						
1,600 x 1,280	N/A	N/A	24,000 / 75 Hz	16.7 million / 85 Hz	N/A	16.7 million / 85 Hz
1,280 x 1,024	16.7 million / 85 Hz	16.7 million / 85 Hz	16.7 million / 75 Hz	16.7 million / 100 Hz	16.7 million / 85 Hz	16.7 million / 120 Hz
1,152 x 864	16.7 million / 85 Hz	16.7 million / 120 Hz	16.7 million / 76 Hz	16.7 million / 100 Hz	16.7 million / 85 Hz	16.7 million / 180 Hz
1,024 x 768 and below	16.7 million / 85 Hz	16.7 million / 120 Hz	16.7 million / 100 Hz	16.7 million / 100 Hz	16.7 million / 85 Hz	16.7 million / 180 Hz
RAMDAC speed	220 MHz	220 MHz	220 MHz	250 MHz	170 MHz	220 MHz
Software						
On-the-fly resolution/refresh/color-depth adjustment	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Virtual desktop maximum size (pixels):	N/A	N/A	N/A	N/A	N/A	2 million
Pan and zoom/Auto-centering	N/A	N/A	N/A	N/A	N/A	■ ■
x/y scaling support for video playback	■	■	■	■	■	■
Color space conversion, YUV to RGB	■	■	■	■	■	■
Color calibration of RGB value	■	■	■	■	■	■
Proprietary graphics utility	AccelPanel	3D Win-3D Viewr	None	GLoria Setting, Winman	None	Omnicom Graphics
3-D Features						
Z-buffer depths supported	24-bit	24-bit with 8-bit overlay	16-bit, 24-bit	32-bit	24-bit, 32 bit	24-bit
Accelerated double-buffered color depths:						
1,920 x 1,080	N/A	N/A	N/A	32-bit	N/A	24-bit
1,600 x 1,280	N/A	N/A	16-bit	32-bit	N/A	24-bit
1,280 x 1,024	24-bit	24-bit	24-bit	32-bit	24-bit	24-bit
1,152 x 864	24-bit	24-bit	24-bit	32-bit	24-bit	24-bit
1,024 x 768	24-bit	24-bit	24-bit	32-bit	24-bit	24-bit
800 x 600	24-bit	24-bit	24-bit	32-bit	24-bit	24-bit
Supports OpenGL 1.2	■	■	■	■	■	■
Other APIs supported	Direct3D, Heidi	Heidi	Heidi	AutoCad, Direct3D, Heidi, 3D Studio Max R2	Heidi, RenderGL	Direct3D, Heidi
Bilinear texture filtering/Trilinear MIP mapping	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Anisotropic texture filtering/Perspective correction	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Subpixel rendering accuracy/Antialiasing	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Alpha blending/Transparency	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Specular highlighting/Fog/Stenciling	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Video-texture mapping	■	■	■	■	■	■
Support						
Toll-free technical support	■	■	■	■	■	■
Technical-support hours	8:00-8:00 M-F	11:00-8:00 M-F	11:00-9:00 M-F	11:00-9:00 M-F	9:00-7:00 M-F	9:00-4:00 M-F
Warranty	3 years	3 years	3 years	6 years	3 years	2 years
Web address	www.accelgraphics.com	www.diamondmm.com	www.dynamicpictures.com	www.elsa.com	www.intergraphics.com/ics	www.omnicomp.com

N/A—Not applicable: The product does not have this feature.

correction and texture-filtering portions of the quality checks.

Although the Power Threads drivers look promising, they did not ship in time for use in our formal testing. In multi-CPU systems, the new drivers allow individual chips in the Oxygen 402 to focus on a particular thread in multithreaded Win-

dows NT applications such as 3DStudio Max; this should improve performance significantly. Currently, the Oxygen 402's architecture allows a small amount of parallel processing by allocating different portions of the screen to each on-board Oxygen chip. That functionality let the seemingly outclassed Oxygen 402 per-

form well on the large-texture SoftImage and 3DStudio Max tests.

On other applications, the accelerator performed poorly. The card finished last on the MCAD and Animation tests and was unable to run the Simulation test in a reasonable time. Results were similarly poor on the Lightwave 3D, AVS/Express

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High-End Graphics Cards

and Pro/Engineer tests, and the accelerator's 2-D performance for typical productivity chores was disappointing.

SoftImage animators will appreciate the Oxygen's optimized drivers, but for most mainstream 3-D developers, the sweet spot has moved elsewhere.—*JH*
Dynamic Oxygen 402. List price: \$2,299. Dynamic Pictures Inc., Santa Clara, CA; 800-464-3348; www.dynamicpictures.com. Choose 502 at www.pcmag.com/infolink.

ELSA GLoria-XL

Armed to the teeth with 3Dlabs setup and rendering engines and 40MB of on-board RAM, the ELSA GLoria-XL (\$1,650 street) was nonetheless a lackluster performer on most of our performance tests. Throw in installation hassles and you've got a card that's difficult to recommend over others in this roundup.

The GLoria-XL is built around 3Dlabs' Delta geometry processor and Glint MX rendering chip, with a 16MB VRAM frame buffer and up to 40MB of EDO DRAM texture memory (we tested with 24MB), which produces 24-bit double-buffered resolutions up to 1,920-by-1,080. In addition to Heidi and display list drivers for AutoCAD, the GLoria-XL bundles ELSAview 3D, a display utility for AutoCAD and Autodesk Mechanical Desktop.

The GLoria-XL's setup routine failed to install the card's display utilities, which we ultimately installed manually from the Display Panel. Once installed, the GLoria-XL drivers contain application presets for AutoCAD, LightWave 3D, SoftImage, 3D Studio Max, and other programs.

Unfortunately, application-specific support didn't translate to superior performance on our benchmark tests. The GLoria-XL placed sixth on the Indy3D MCAD test and last on our Pro/Engineer test, taking almost twice as long to render as our fastest accelerators. Though the card aced several animation-related tests, it lagged as tests became more geometry-intensive, often producing less than half the frame rate of the leaders. Bright spots were the card's above-average performance on all 2D ZD WinBench tests and unblemished scores on output quality tests. In general, however, the GLoria-XL just doesn't stack up against

the competition in this roundup.—*JO*
ELSA GLoria-XL. Street price: \$1,650. ELSA Inc., Santa Clara, CA; 800-272-3572; www.elsa.com. Choose 503 at www.pcmag.com/infolink.

Intergraph Intense 3D Pro 2200S

The Intergraph Intense 3D Pro 2200S (\$1,390 list) is near the bottom of Intergraph Computer Systems' RealizM II 3-D product line of graphics accelerators, but this low-end solution performed admirably on a wide range of tests, making it a good option for everything from CAD and architectural design to animation. The accelerator was also the fastest 2-D performer in the roundup, and the company does not cut corners to hit the product's attractive price.

Start, for example, with the 3D Pro 2200S's huge IBM 9314 Palette DAC. Multiple Look-Up Table (LUT) support in the IBM 9314 doesn't affect raw

benchmark test scores: Its purpose is to allow for smooth color transitions in rapidly changing scenes.

Installation under Windows NT 4.0 was a breeze. The driver shows the amount of frame buffer and texture memory (16MB for each, in our test unit) and gives access to performance-related check boxes.

The 3D Pro 2200S passed all our 3-D quality-inspection tests and supports virtually all 3-D effects and features. The card wasn't a far-and-away leader on any single performance measure; instead, it delivered solid scores across our various application tests. The 3D Pro 2200S's CAD performance, in particular, was strong, as was its animation performance. Simulation applications such as AVS/Express exposed the accelerator's raw throughput limitations, however.

The Intergraph Intense 3D Pro 2200S is particularly suited to midrange CAD work, and this versatile product held its own on animation tasks. The card was one of the few products that excelled on 2-D tasks, making it more than adequate for supporting image-editing packages, such as Photoshop, at a reasonable pace.—*JH*
Intergraph Intense 3D Pro 2200S.

List price: \$1,390. Intergraph Computer Systems, Huntsville, AL; 800-763-0242; www.intergraph.com/ics. Choose 504 at www.pcmag.com/infolink.

Omnicom 3Demon MX16/16

Attractively priced at \$1,300 (street), Omnicomp's 3Demon MX 16/16 generally trailed the pack in performance. It scored well on our Lightwave 3D and 2D Windows Acceleration tests, but this Glint-based card was often overpowered by cards based on other chip sets.

The MX16/16 ships with 3Dlabs' Delta geometry setup engine and Glint MX rendering engine, along with 16MB of VRAM frame buffer memory and 16MB of EDO DRAM texture memory (upgradable to 32MB). This enables the 3Demon to generate 1,920-by-1,080 double-buffered resolution at an acceptably high maximum refresh rate of 75 Hz, jumping to an even more stable 85 Hz at 1,600-by-1,200. The display utility offers several general optimization capabilities, but the only application-specific presets are for SoftImage.

The card's performance on our animation tests was mixed: The MX16/16 was the fastest card on our Lightwave 3D suite of tests but was below average on other animation tasks. CAD and modeling/simulation tests also placed the accelerator near the bottom, sometimes trailing the leader by 50 percent or more. We noticed that some CAD images were rendered incorrectly on the Indy3D and Pro/Engineer tests. Only on the Windows Acceleration tests did MX16/16 truly excel, far outdistancing all other cards on the High-End Graphics WinMark 98 test and placing first or second on all other tests.

If your work is heavily weighted towards big-screen 2-D tasks, the MX 16/16 is worth a look. If you're seeking the fastest rocket into the 3-D universe, however, find another launching pad.—*JO PC*

Omnicom 3Demon MX16/16. Street price: \$1,300. Omnicomp Graphics Corp., Houston; 713-464-2990; www.omnicomp.com. Choose 505 at www.pcmag.com/infolink.

SUITABILITY TO TASK

Intergraph Intense 3D Pro 2200S

CAD/CAM	Good
Animation	Fair
Modeling and simulation	Fair
2-D Windows	Excellent

SUITABILITY TO TASK

ELSA GLoria-XL

CAD/CAM	Poor
Animation	Fair
Modeling and simulation	Fair
2-D Windows	Good

SUITABILITY TO TASK

Omnicom 3Demon MX16/16

CAD/CAM	Fair
Animation	Good
Modeling and simulation	Fair
2-D Windows	Excellent

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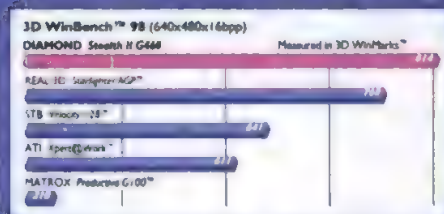
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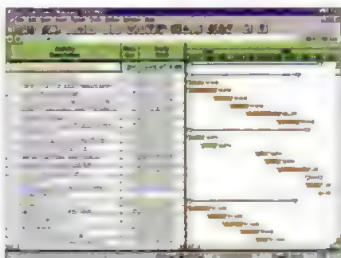
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PROJECT MANAGEMENT

According to Plan

The latest project management programs can transform the daunting into the doable.

By Nelson H. King



Somewhere between planning an office party and building the next *Titanic* lie the numerous projects you labor at every day. Many of these projects can't be managed in your head: There are too many

things to do and too many people involved, and of course everything must stay within budget. Planning on paper can help. But as projects grow larger or stray from the original objectives—as they always do—paper plans quickly become inadequate. Project management software solves this problem by letting you create and track every detail of a project from start to finish.

At the most basic level, the project management packages we review here help you describe a project. But the real trick is to create a plan that closely mirrors the actual work and to track the project as it goes along. That is where project management software becomes invaluable. You can use it, for example, to adjust assignments automatically to make the best use of workers's time, modify or postpone tasks, publish reports, and use the Internet to track the status of ongoing tasks. In short, project management software gives you tools not only to *plan* a project but also to *manage* it.

In this story, we review six mainstream project management packages: CA-SuperProject 4.0, Microsoft Project 98, Project Scheduler 7, SureTrak Project Manager 2.0, Time Line 6.5, and TurboProject Professional 2.0. The packages range in cost from \$300 to \$600 (street).

IN THIS REVIEW

CA-SuperProject 4.0.....	211
Microsoft Project 98.....	212
Project Scheduler 7.....	216
SureTrak Project Manager 2.0.....	217
Time Line 6.5.....	221
TurboProject Professional 2.0.....	221
Editors' Choice.....	211
Getting More Out of Project Management Software.....	212
Project Schedulers: Painless Planning.....	214
Project Management Terminology.....	217
Performance Tests.....	218
Summary of Features.....	222

Project management software has never been known for its ease of use, but there is no doubt that these programs have made strides in this area. The packages we tested include extensive help systems and tutorials. Several include wizards that help you build projects from scratch; SureTrak's new KickStart wizard is especially thorough. Other packages, such as TurboProject, provide project templates.

These features make project management software suitable for a wide range of users, from timepressed managers to full-time planning professionals. Nevertheless, project management programs

are still more difficult to use than typical office productivity applications, and they are not for everyone. Whether you should use one depends on several factors: the complexity and length of the projects you typically tackle, the number of resources involved, and your level of technical know-how.

If your needs are relatively basic, you might opt for a project scheduler (see the sidebar "Project Schedulers: Painless Planning"). At the opposite extreme are high-end tools designed for managing multiple large projects within the enterprise. Major players here include Primavera Project Planner (P3) and Welcom

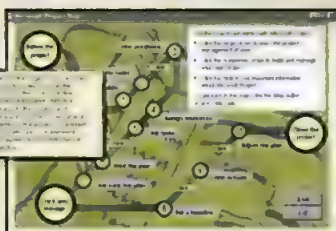
Software Technology's Open Plan Professional (800-274-4978, www.welcom.com). If you decide to take the plunge into project management software, we recommend that you consider investing in a training program (see the sidebar "Getting More Out of Project Management Software").

To begin planning a project using one of the programs reviewed here, you compile a list of what needs to be done (*tasks*) and the people who can do it (*resources*) and then lay out the sequence of tasks, estimate how long they will take, and assign resources to them. Most of this work is typically done in a *Gantt chart*, a

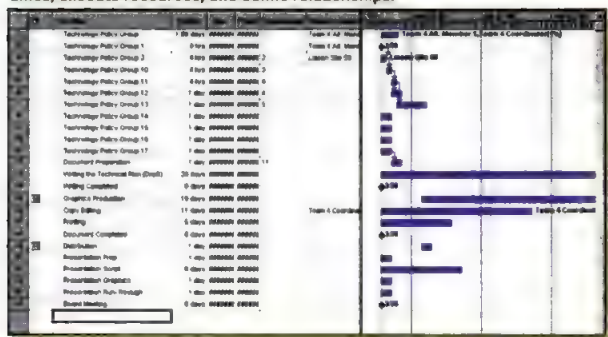
The Phases of Project Management

Project management can be a complex field. But once you get past all the jargon, the basic principles behind planning and keeping tabs on a project are actually quite simple. In this example, we use Microsoft Project 98 to demonstrate some of the basic features and functions of project management software.

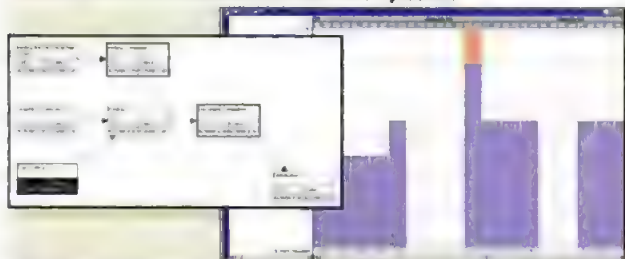
1 Getting a Head Start Project management software is becoming easier to use. Many products have wizards and templates that help you get started. Microsoft Project 98 provides the Project Map, which illustrates the process of project management and gives instructions for the steps required.



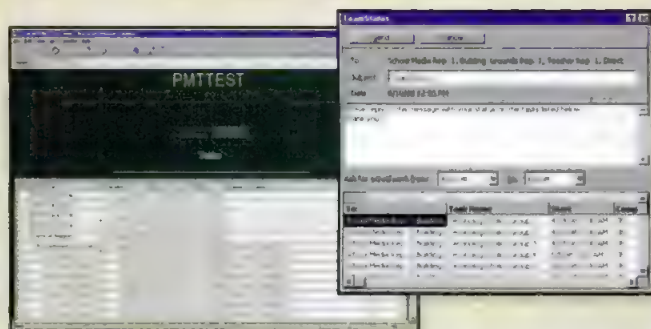
2 The Basic View The Gantt chart view is an easy way to enter data and view the main elements of your project. Here, you can enter tasks and duration times, allocate resources, and define relationships.



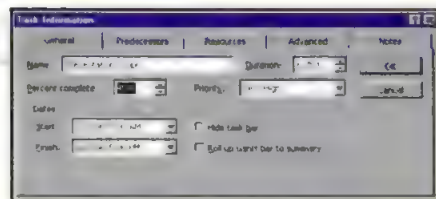
3 Different Perspectives on Your Project When you're tracking a project, using different views can help add perspective. The PERT view clearly illustrates workflow, while the *resource usage* view (a histogram) represents the amount of work assigned to individual resources. In this instance, a red bar signals that a resource has been overallocated and will cause a problem.



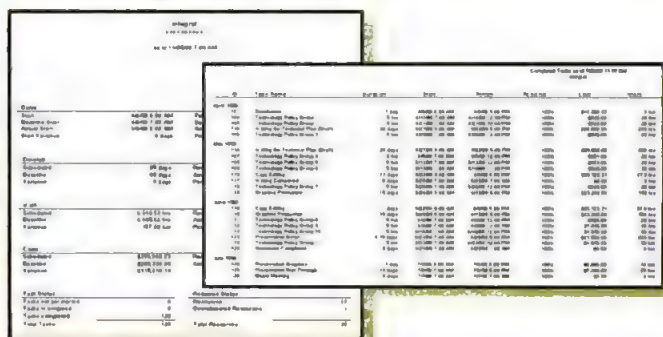
4 Workgroup Features An important part of managing a project is communicating with team members. Tools such as e-mail and HTML reports make sharing data with team members easier than ever. Microsoft Project 98, for example, includes e-mail forms that you can use to assign tasks and keep tabs on ongoing tasks. Many vendors rely on add-ons or separate products to provide this functionality.



5 Project Tracking Project management software does more than just schedule projects. It lets you track how an actual project compares with what you initially planned. In this example, we've entered the percentage of work completed for a task, and Project 98 automatically updates all of the views. By keeping your plan up to date, you can compare the *actuals* with the initial expectations (the *baseline*).



6 Reporting Most of the products we reviewed include report writers, which let you generate reports displaying information ranging from task completion time to an overview of project costs. Some products, such as Time Line Solutions' Time Line 6.5, include powerful third-party report writers.



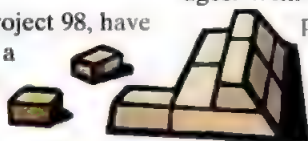
graphical display of tasks and their relationships to one another. By associating costs with each of your resources, you can also come up with a budget for the project. When you're done, you have a detailed project plan.

The proper allocation of resources is crucial to the success of a project. Project management programs provide several tools for maximizing efficiency. All the programs flag potential problems in regular views, such as Gantt charts, and automatically link data from the views to more detailed resource allocation graphs. Once you locate problems, you can fix them manually by adjusting task duration or reassigning work, or you can use your program's built-in resource-leveling feature to help resolve the problems. Results vary depending on the quality of the resource-leveling algorithm used by the program.

Professional project managers look for more complex features. One example is how project management programs differentiate between the amount of work expended (*effort*) and the actual time it takes to complete the task (*duration*). A job such as laying a concrete sidewalk might require 6 hours of work but have an actual duration of 3 days because of the time it takes for concrete to cure. Some programs give you tools to profile the uneven distribution of effort over the duration of the task, a process known as *resource contouring*. Other professional-level features include the ability to manage multiple projects and to share data with other applications using OLE (Object Linking and Embedding) and ODBC (Open Database Connectivity).

All the products we review let you configure the project views (such as Gantt charts) and print them. Many of the vendors also bundle or integrate third-party report writers, such as Seagate Software's Crystal Reports, with their programs. More recently, project management programs have gained the ability to generate HTML-based reports.

A few, most notably Project 98, have taken Internet features a step farther, using e-mail to assign tasks and keep



Editors' Choice

• Microsoft Project 98



technical expertise want quick and easy solutions, and project planning professionals demand a litany of power features. Only one product, Microsoft Project 98, currently satisfies the needs of both types of users, earning it our Editors' Choice.

In a category where ease of use has traditionally taken a back seat to power, Microsoft is driving Project 98 in a different direction. As part of the omnipresent Microsoft Office family, Project 98 closely adheres to the suite's familiar conventions and includes its own animated Office Assistant. Project Map, a new feature, lays out the steps involved in creating and managing a project. And the online documentation is extensive.

Of course, to be effective, project management software must also be

Project management programs face a tough task. The six programs we tested strive to meet the needs of a wide range of users. Busy managers with little

powerful. Project 98 doesn't disappoint. It can now accommodate an unlimited number of tasks and resources (depending on system memory) and consolidate as many as 1,000 subprojects. And the program has an array of new project modeling and tracking tools. Finally, Project 98 is at the forefront of the push toward Internet-based project collaboration with built-in e-mail forms. No matter what the task, Project 98 has the tools to keep you on time and on budget.

An honorable mention goes to Scitor Corp.'s Project Scheduler 7. With its flexible scheduling options, highly configurable database, support for up to five baselines, and excellent multiple-project management, Project Scheduler is a great choice for professionals who place more emphasis on power than ease of use.

track of the status of projects. Primavera's Webster, an add-on to SureTrak, lets you manage projects on an intranet. Though promising, most of these Internet features still feel like works in progress. But you can expect them to evolve as vendors respond to competition from new Java-based project collaboration tools, such as Netmosphere's ActionPlan and WebProject (reviewed in "Your Guide to Java for 1998," April 7, 1998).

Today's project management programs provide a wider range of features than ever before, in easier-to-use packages. With all the options, you'll find a

program that can tackle the tasks at hand, no matter what size project you're planning to take on.

Computer Associates International Inc.

CA-SuperProject

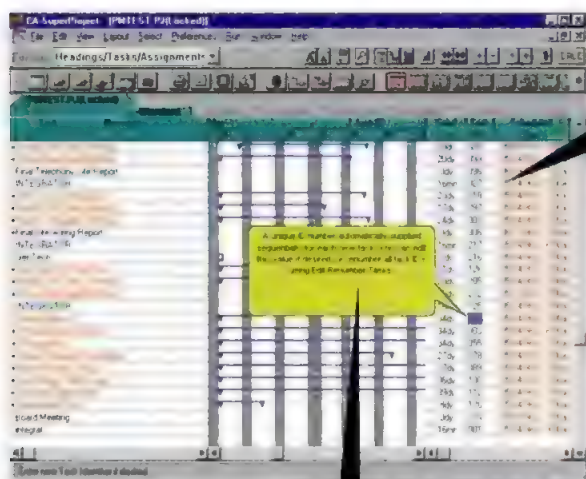
A landmark in the project management landscape, CA-SuperProject 4.0 (\$450 street) offers a range of powerful project scheduling and modeling features. But though its foundation is strong, the structure is aging: SuperProject's interface is dated, and we found the program difficult to use. Version 5.0, slated to be in beta this summer, should address these look-and-feel issues.

One part Windows 3.x software and one part Windows 95 software, SuperProject is ripe for a makeover. And the learning process can be quite involved. But once you've grasped the commands, you can do almost anything with keystrokes, making SuperProject fast and efficient.

Some of the ease-of-use features proved helpful. For instance, there are five distinct planning modes, each dis-

Our Contributors: NELSON H. KING is a frequent contributor to *PC Magazine*. CRAIG STINSON is a contributing editor. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

Project Management



culations, and one of the most effective resource-leveling functions we tested.

CA-SuperProject's main view is equal parts spreadsheet and Gantt chart.

The program's resource management features are especially strong and include details such as resource factoring, which lets you designate how efficiently somebody is likely to work on a particular task.

For tracking a project, SuperProject lets you save up to three baselines and provides more ways to display and

analyze project information than any other product in this roundup. In addition to the usual features, SuperProject offers Organization, Work Breakdown, and calendar charts. We also liked the use of cross-tab views that can be used to view cost data by date and account, for example.

SuperProject's ability to customize views is vast. Every view can be printed as you see it on the screen, or you can choose from a set of canned reports. Unfortunately, we found many of the views and charts poorly designed and difficult to

playing different levels of data and calculations. Neither Time Line nor TurboProject—two packages that you would expect to have this type of help, since they are aimed at novices—offered a similar feature. SuperProject also has an excellent online tutorial. But its balloon-help system, Assist Mode, obscures dialog boxes, making the program more difficult to use.

SuperProject's strength lies in its project-modeling and scheduling capabilities. The product supports a wealth of details, including work shifts, overtime management, five types of tasks, effort-based cal-

The new balloon help system occasionally gets in the way.

Getting More Out of Project Management Software

Although project management packages have become easier to use, they remain more complex than typical office productivity applications such as word processors or spreadsheets. To get the most out of them, you'll want to invest in a training course. Most vendors or resellers offer such programs. You may also find local training centers that offer similar courses.

CA-SuperProject 4.0

Computer Associates International (CA) offers two training programs for CA-SuperProject 4.0: a three-day Basics course and an Advanced program that requires two days. In addition, CA conducts a one-day course outlining the differences between CA-SuperProject 4.0 and previous versions of the program. Training programs at CA Learning Centers (in various locations) start at \$425 per student per day. A client site visit costs \$4,250. (781-320-7608; www.superproject.com.)

Microsoft Project 98

Resellers provide a range of courses for beginners to advanced users. Most courses are from one to two days in length and cost about \$250 to \$300 per day (in some cases, less for larger groups). Some resellers also offer on-site training classes that cost about \$2,000 per day plus travel expenses. Exact costs vary depending on the region, number of students, and the length of the course. (www.microsoft.com/project)

Project Scheduler 7

A three-day Accelerated Project Scheduler course is

designed to get users up and running quickly. Training is provided at Scitor's Menlo Park, California, location and starts at \$700 per person. Regional courses are also available. On-site training costs \$4,700. (800-745-8400; www.scitor.com.)

SureTrak Project Manager 2.0

Primavera Systems conducts a public, two-day Introduction to SureTrak Project Manager course for \$795 per person in various locations. On-site training starts at \$3,000 per day plus expenses. (610-660-7540; www.primavera.com.)

Time Line 6.5

Time Line resellers provide both introductory (two days) and advanced (one day) courses at regional computer training centers. The cost is typically \$900 per day for up to five students. (415-898-1919; www.tlsolutions.com.)

TurboProject Professional 2.0

IMSI provides a training manual used both for self-instruction and by resellers. Training courses based on the manual require one to three days and cost about \$2,500 per day. (415-257-3000, ext.379; www.turboproject.com.)

use. Furthermore, the report writer—part of CA-Realizer, the bundled programming language—is not fully integrated.

In this version, Computer Associates International (CA) has streamlined the process of managing multiple projects. The program now supports resource-pool management, multilevel password security, and the combining of project reports. On our Project Consolidation test, SuperProject posted an average score.

SuperProject is not intended to be a workgroup solution, and it lacks network- and e-mail-based features. Instead, CA now offers a separate product, CA-SuperProject Net (\$1,750 street, including SuperProject licenses for a manager and 20 users), that provides this functionality.

SuperProject has enough power and flexibility to keep a professional project manager happy for years. If CA can improve its usability, SuperProject will be a formidable challenger.—*Nelson H. King*
CA-SuperProject 4.0. Street price: \$450. Computer Associates International Inc., Islandia, NY; 800-225-5224, 516-342-5224; www.superproject.com. Choose 550 at www.pcmag.com/infolink.

Microsoft Corp.

Microsoft Project 98



Microsoft Project has always had a reputation as the project manager for the rest of us: It's easy to learn and easy to use.

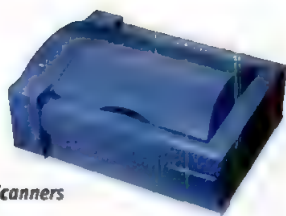
But serious project managers have frowned on Project's inadequate handling of large-scale projects, its inflexible scheduling engine, and other shortcomings. With Microsoft Project 98 (\$500 street), Microsoft delivers the tools the pros have been clamoring for—aside from a few lingering omissions, such as multilevel undo—without sacrificing usability. The product emerges as the best choice for most users.

Although Project 98 lacks an in-depth project startup wizard, it is still the easiest to use of the programs we tested. The new Project Map walks you through the steps involved, from defining a project to tracking and managing it. The help system is extensive, and the animated Office Assistant is included.

A new vertical toolbar provides quick access to all the program's views. In the Indicators field, an especially useful new

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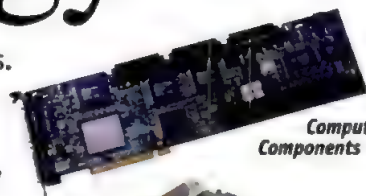
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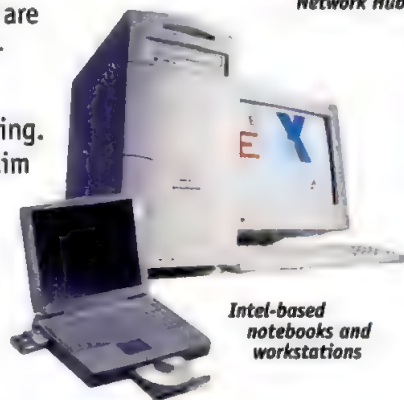


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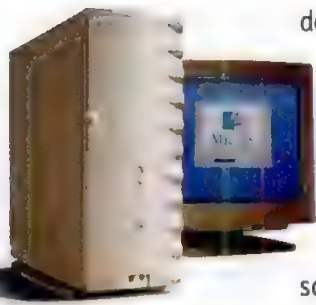
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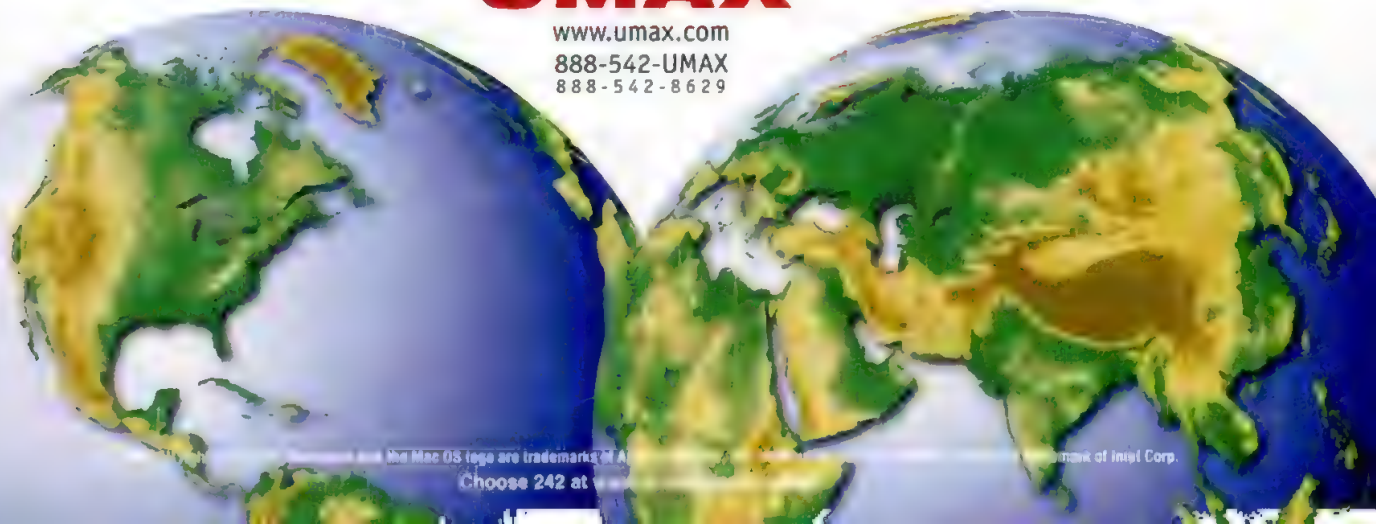
Intel-based notebooks and workstations



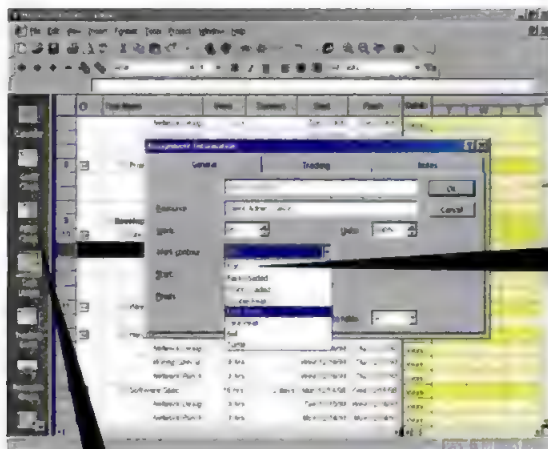
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Project Management



A new toolbar provides quick access to the most commonly used charts and graphs.

Microsoft Project 98 provides preset resource contours.

feature, icons and pop-up messages provide feedback on the status of tasks. You can see at a glance if a resource is overallocated, when a task is completed, and whether any notes are linked to the task.

To help users model real-world condi-

tions, Project 98 supports resource contouring, multiple cost rates per resource, and cost rates that change over time. Resource-rate tables let you account for anticipated changes in resource costs and for workers

who have different pay rates for different types of work. Project 98 also improves cost modeling with three fixed-cost accrual options—accrue at start, accrue at finish, and prorate across task duration.

Another area that Microsoft improved is project tracking. With Project 98, you can perform task splitting and PERT probability analyses, enter actual costs, and set multiple critical paths. Unlike previous versions, Project 98 will not

delay an entire task if only one of the resources assigned to it is overallocated.

Project 98's approach to multiproject management has been simplified. You can insert subprojects at any outline level while retaining all the functionality of independent projects. Furthermore, tasks and resources are now limited only by system memory, and Project 98 can consolidate as many as 1,000 projects.

For exporting project data, Project 98 relies on a new file format, MPD (the program still supports MPX for backward compatibility). MPD is simply a Microsoft Access database file with a different file extension, letting managers perform queries across projects from within Access.

Workgroup features have also been enhanced in Project 98. The custom e-mail forms used by team members for status updates now include fields for reporting period-by-period



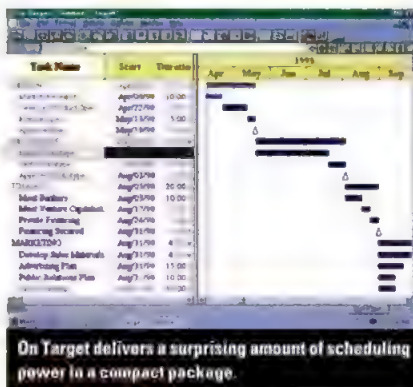
Project Schedulers: Painless Planning

The project management packages reviewed in our main story provide a range of tools to help bring the project to fruition. Many managers, however, simply need a product that will help them deal with day-to-day deadlines and scheduling. Project schedulers are designed to meet these needs.

On Target 2.0, from Franklin Covey Co., delivers a great deal of scheduling power for \$100 (street). On Target can create Gantt and PERT charts, calculate the critical path, and perform resource leveling and rudimentary cost accounting. For added convenience, it can be fully integrated with Ascend, Franklin Covey's personal information manager. (Franklin Covey Co., Salt Lake City; 800-877-1814; www.franklinquest.com. Choose 556 at www.pcmag.com/infolink.)

Making Gantt charts exciting enough to motivate team members is always a challenge, but Kidasa Software may have the answer. With **Milestones, Etc. 5.0** (\$200 list), you get a luxurious set of charting symbols and connectors that can be used to illus-

trate the dependencies among project tasks. Milestones supports OLE and OLE automation, and it provides import and export filters for Microsoft Project 98 and Time Line. (Kidasa Software Inc., Austin, TX; 800-765-0167; www.kidasa.com. Choose 557 at



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ActionBook 300C	MMX166	7 lbs.	16 MB	2.1GB	256k	12.1" DSTN	33.6k	24X	\$1399

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progress data. Project 98 ships with Personal Web Server and tools for intranet-based collaboration.

Project 98 has its shortcomings. We'd like to see the ability to link project files to HTML reports, multilevel undo, support for hammock tasks and custom formulas, and the ability to track consumables. But in the end, Project 98 offers the best balance of power and usability.—Craig Stinson

Microsoft Project 98. Street price: \$500. Microsoft Corp., Redmond, WA; 800-426-9400, 425-882-8080; www.microsoft.com. Choose 551 at www.pcmag.com/infolink.

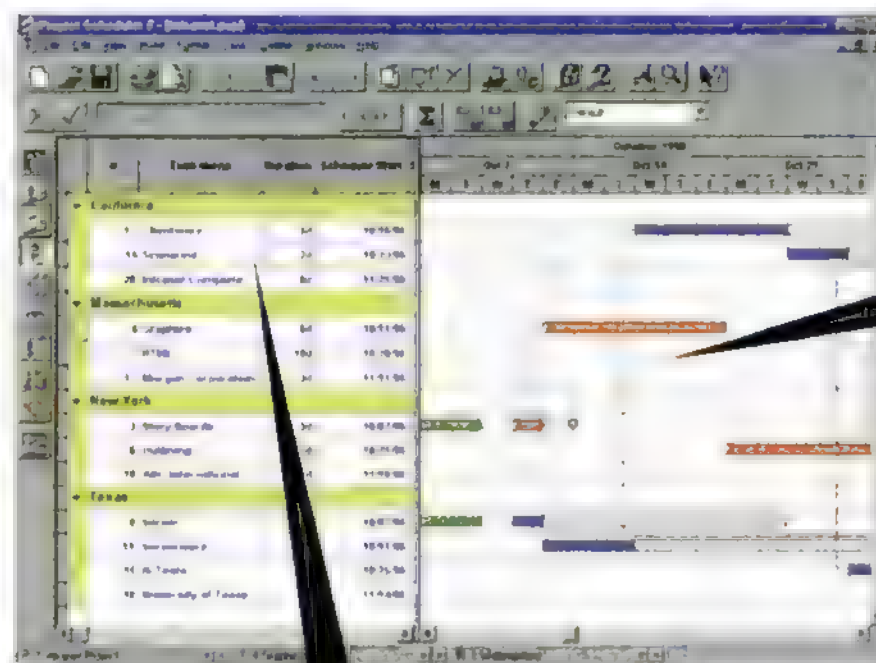
Scitor Corp.

Project Scheduler

Behind the simple-looking interface of Scitor Corp.'s Project Scheduler 7 (\$600 street) lurks a high-performance database system and enough project modeling power to satisfy the most demanding project manager. But Project Scheduler has some weaknesses: It lacks start-up wizards and templates, and its workgroup features fall short of those in Microsoft Project 98.

Scitor maintains a consistent and flexible interface by sticking mainly with spreadsheet-style views that display tasks, resources, and costs; Gantt and PERT

Highlights include inflation profiling, overtime calculations, and task splitting during resource leveling. Project Scheduler lets you assign due dates for tasks, as well as start and end dates for the work associated with each task—an arrangement that provides more flexibility than the single "must finish by" con-



Project Scheduler supports an unlimited number of custom fields and formulas.

chart views are also available. Data bands let you select any field (within both tasks and resources) to order and summarize a spreadsheet on the fly.

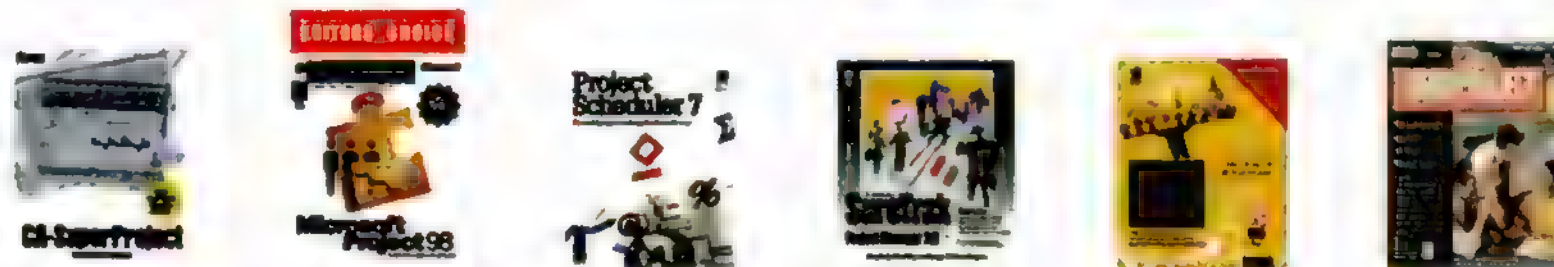
The list of scheduling and project-modeling features in Project Scheduler is long.

straint used in other programs.

Project Scheduler boasts a resource-assignment form (a feature likely to be emulated) that shows a list of people who can be assigned to a task and how much of their time is still available.

Bolstered by a robust database system, Project Scheduler supports an unlimited number of user-defined fields and user-defined formulas and up to five baselines—the most of any product in our roundup. The same sort of flexibility shows up in creating reports, which can be printed from

SUITABILITY TO TASK



	CA-SuperProject 4.0	Microsoft Project 98	Project Scheduler 7	SureTrak Project Manager 2.0	Time Line 6.5	TurboProject Professional 2.0
POWER						
Setup	Excellent	Excellent	Good	Excellent	Excellent	Good
Tracking and modification	Excellent	Excellent	Excellent	Good	Good	Good
Resource management	Excellent	Excellent	Good	Fair	Excellent	Good
Multiple projects	Excellent	Excellent	Excellent	Excellent	Good	Good
Reporting	Good	Good	Excellent	Good	Excellent	Fair
Workgroup capabilities	N/A	Excellent	Fair	Good	Fair	Fair
Customization and integration	Good	Good	Fair	Fair	Good	Fair
EASE						
Setup	Good	Excellent	Good	Good	Good	Good
Tracking and modification	Fair	Excellent	Excellent	Good	Good	Good
Resource management	Good	Excellent	Excellent	Fair	Excellent	Good
Multiple projects	Good	Excellent	Excellent	Good	Good	Fair
Reporting	Fair	Excellent	Good	Good	Good	Good
Workgroup capabilities	N/A	Excellent	Good	Excellent	Good	Good
Customization and integration	Good	Excellent	Good	Good	Good	Good

N/A—Not applicable: The product does not have this feature. Computer Associates offers a separate product, CA-SuperProject Net, with workgroup capabilities.

For the first task, **setup**, we evaluate each program's installation and tutorials, as well as the process of creating new projects and assigning resources. For **tracking and modification**, we weigh the program's views of project data (such as Gantt and PERT), filtering and search tools, and the process of entering actuals and comparing the data to baselines. To gauge the program's **resource management** capabilities, we test the tools used for resource leveling, resource contouring, and resource pooling. Other important features include the ability to create work shifts, track consumable goods, and account for fluctuations in costs due to overtime or inflation. Under **multiple projects**, we evaluate the program's ability to consolidate several projects into a single

master project. We also test each program's ability to level resources across multiple projects. To rate **reporting** features, we test both general reports (Gantt, PERT, calendar, resources, baseline comparison, and so on) and cost and accounting reports. We also look at tools for creating ad hoc reports (including bundled report generators) and exporting data to HTML. Important **workgroup capabilities** include the product's ability to take advantage of the Internet and e-mail to improve project collaboration, as well as support for client/server environments and security. For the final task, **customization and integration**, we evaluate each program's import and export capabilities, support for ODBC and OLE, and built-in scripting and macro languages.

any view or designed from scratch using the built-in report writer. Unlike CA-SuperProject or Microsoft Project 98, Project Scheduler lacks a programming language.

Project Scheduler has long been a leader in managing multiple projects. Its two main approaches, a master project with multiple subprojects and consolidation of projects, are sophisticated yet easy to use. CA-SuperProject and Microsoft Project 98 now have similar capabilities, but Project Scheduler has stayed ahead with the ability to create groups of projects and set scheduled dependencies among them.

Not surprisingly, Project Scheduler excelled on our Project Consolidation test. It did not perform as well on the Gantt Chart Printing test, however.

For the workgroup environment, Project Scheduler supports OLE and ODBC, HTML report publishing, and the ability to send e-mail from within the program. Unlike Microsoft Project 98, Project Scheduler cannot automatically update projects via e-mail. A separate add-on product, Project Communicator (\$2,000 street for ten seats), provides that feature.

Overall, we give Microsoft Project 98 the edge,

SureTrak's Web Publishing Wizard lets you build intricate HTML-based reports.

because it is easier to use, offers better workgroup features, and meets the needs of a broader audience. By contrast, Project Scheduler is a powerful and highly configurable tool designed by and for professional project managers.—*NHK*
Project Scheduler 7. Street price: \$600. Scitor Corp., Menlo Park, CA; 800-533-9876, 650-462-4200; www.scitor.com. Choose 552 at www.pcmag.com/infolink.

Primavera Systems Inc.

SureTrak Project Manager

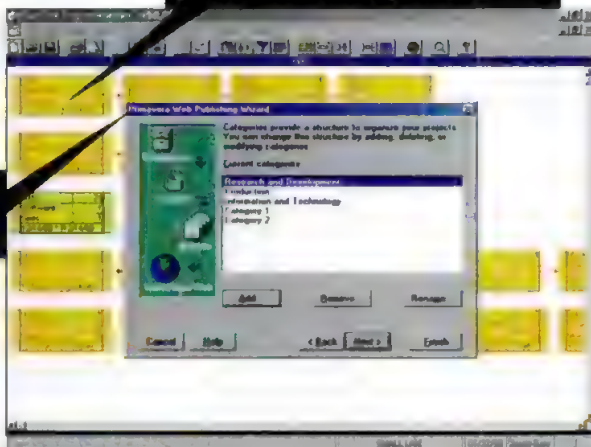
Both a standalone project management program and a departmental front end to Primavera Project Planner (P3), SureTrak Project Manager 2.0 (\$400 street) is an attractive option for large organizations that already use P3. In addition, SureTrak's Webster add-on is an innovative tool for managing projects

on an intranet. But on its own, SureTrak falls short of the better programs we reviewed in terms of features and usability.

The new Project KickStart Wizard helps novices set up projects with a series of detailed questions about tasks and resources. Unfortunately, after a good start, SureTrak slows you down. We found the program difficult to use, and we often had trouble locating specific features. Furthermore, the program maintains Windows 3.x conventions that will frustrate users accustomed to working in Windows 95.

SureTrak can handle projects with as many as 10,000 tasks, and the number of subprojects you can consolidate is limited only by available RAM. The program lets you track revenue and costs associated with resources, as well as assign up to six limits to a resource's availability. You can easily model a situation where, say, four technicians are available during a project's first four months and only two for the last

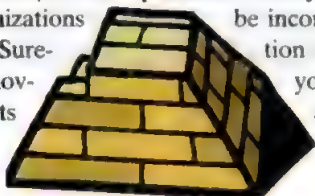
In the PERT view, SureTrak's Trace Logic isolates particular tasks and their dependencies.



three weeks. But SureTrak does not model overtime costs without a workaround, nor does it offer custom field calculations.

The well-designed PERT view includes a Trace Logic window that lets you isolate a particular task and its dependencies. Activity codes, such as *responsibility* and *phase*, can serve as project organizational tools and generate attractive "banding" heads in tabular views. But outlining is not as intuitive as it ought to be.

SureTrak can handle multiple critical paths, and it lets you specify that some float be incorporated into the definition of what is critical. Thus you can have activities that are almost critical stand



Project Management Terminology

Baseline A "snapshot" of a project's current status, including duration, cost, start date, end date, and status of all tasks.

Critical path A chain of tasks, linked by dependencies, that determines the shortest possible length of the project.

Duration A measure of the total elapsed time spent on a task from start to finish.

Effort The number of actual labor hours needed to complete a task.

Float (or slack) time The amount of time a task can slip without affecting target dates within the project.

Gantt chart A graph consisting of horizontal bars that depict the start date and duration of each task.

Hammock task A task with start and end dates that depend on other tasks. Also known as a *bridge* task.

Histogram A bar graph that shows how resources (and sometimes costs) have been allocated to tasks within intervals of time.

Lead and lag time Extra time, respectively, before and after the start and end dates for a task.

Milestone A fixed point, usually at the completion of a major task, represented by a task with no duration (zero duration).

ODBC Open Database Connectivity; a standard developed by Microsoft for exchanging data with databases.

OLE Object Linking and Embedding; a standard that allows data from one Windows application to be embedded into another application.

PERT Program evaluation and review technique. Like a flowchart, a PERT chart graphically depicts tasks as a network of dependencies.

Resource contouring A process used to match available resources closely to the amount of work that needs to be done by modeling the work patterns of resources.

Resource leveling A method of eliminating overallocation of resources, typically by delaying certain tasks.

Task splitting The process of splitting a task into two or more tasks, based on completed and unfinished segments, to create additional time or flexibility within a schedule.

Work breakdown structure (WBS) An outline structure used to organize tasks by unique identifiers; frequently used to integrate with accounting and other tracking systems.

PERFORMANCE TESTS

Project Management Software



The six programs we tested yielded varying results. No one package excelled in all

areas, so when choosing among these mainstream products, keep in mind the types of project you typically manage.

What the Numbers Mean

The **Open/Save Large File** test measures the time required to load a large multiproject file and then to save it under a new name. Not surprisingly, we found that the manner in which a product handles project data had a direct correlation to its performance on these tasks. Some programs save data in a single, relatively small file; others scatter data across multiple files. IMSI's TurboProject Professional 2.0, the fastest in our roundup, saved all project data in one relatively compact 314K file. When we saved the same project using Primavera Systems' SureTrak Project Manager 2.0, the poorest performer on this task, it yielded 15 files occupying a total of 1,761K. (SureTrak saves project files in this format to ensure compatibility with Project Planner, Primavera's high-end project management solution.) But we were able to consolidate the files into a single, compressed 215K file for backup and e-mail purposes.

The **Print Gantt Chart** test measures the time a program takes to regain control of the computer after printing a standard Gantt chart displaying data from our consolidated test project. The chart is sized to fit the width of a tabloid-size sheet of paper. The number of pages required to print our Gantt chart ranged from 7 to 12, depending on how each program spaced the rows and bars of the chart. Though the

time and number of pages varied on our printing test, we found these programs capable of producing project management charts at an acceptable speed when using a typical PC. Even Scitor Corp.'s Project Scheduler 7, the slowest on our printing test, took just 21.8 seconds. At the opposite extreme, Microsoft Project 98 needed only about 3 seconds to perform the print job.

Our **Consolidate Multiple Projects** test measures the time required to combine five separate but linked subproject files into a single master file. Two of the products, SureTrak and Time Line Solutions' Time Line, were not able to perform this test in a single step. Both required the user to create a blank master-project file and then run a wizard or dialog box on each subproject file. In these cases, we timed each step separately and reported the sum. Time Line offers a faster alternative to the multistep approach for those who have the foresight to create subprojects within the master project. We didn't use this method, because we didn't feel it fit the spirit of our test, which was designed to gauge performance when combining separate project files.

Again, we saw a wide disparity in the results. Project Scheduler merged the five projects in slightly more than 7 seconds, but Time Line required 89 seconds to complete the same task. Project 98 came in about midway between the two scores.

In addition to the three tests reported here, we also performed a **Resource Leveling** test, which measures the time required to perform a resource-leveling operation using available slack time. We are not charting the results of this test: Resource leveling is difficult to evaluate on an even playing field, because each application performs different algorithms, producing varying results, and you will almost always have to tweak your project manually after running the automatic leveling procedure. Although some programs

require less time to perform resource leveling, the results' quality may be adversely affected; each solution needs to be evaluated individually.

Bearing in mind that caveat, we noticed some differences among the products. Time Line, whose algorithms have developed over the years, was the fastest, with a speed of 2.1 seconds. Project Scheduler, which was at the top of the pack the last time we reviewed these products, was the slowest this time, at 1 minute 9 seconds. Scitor says that it has increased the number of alternatives this version uses to calculate specific conflicts. Using a less granular time increment (weekly rather than daily, for example) can generally increase the speed of recalculation.

How We Tested

To evaluate the performance of project management software, we first imported five medium-size projects, each containing approximately 100 tasks and 100 resources, into each application. The data files were initially stored in Microsoft's MPX file format, the least-common-denominator file format for these products.

Once the files were imported, we made every attempt to insure that the data had been translated correctly. In some cases, we had to modify the MPX files before importing them to insure that we received consistent results. In Time Line, for example, we had to make changes to format settings—such as date format and calculation method—in the original files. Once the five data files had been imported successfully, we then combined them into one large project for use in the performance tests.

We ran all tests using a Micron Millennium Pentium/200 test system with 32MB of RAM. For the Print Gantt Chart test, we used an Epson Stylus Color 3000 printer.—*Analysis written by Diane Jecker*

Bold type denotes first place.
Seconds

	Open/Save Large File	Print Gantt Chart	Consolidate Multiple Projects
CA-SuperProject	3.2	8.9	10.8
Microsoft Project 98	15.7	3.1	47.2
Project Scheduler	6.7	21.8	7.4
SureTrak Project Manager	40.0	10.9	63.1
Time Line	30.4	9.1	89.1
TurboProject Professional	2.8	12.1	9.7
	◀ BETTER	◀ BETTER	◀ BETTER

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Dot Pitch	0.28mm*	0.26mm	0.26mm	0.26mm	0.26mm	0.28mm
Max. Resolution	1600 x 1280	1600 x 1280	1600 x 1280	1600 x 1280	1280 x 1024	1280 x 1024
Optimum Res.	1,280 x 1,024 @89Hz	1,280 x 1,024 @88Hz	1,280 x 1,024 @88Hz	1,280 x 1,024 @79Hz	1,024 x 768 @87Hz	1,024 x 768 @87Hz

*Aperture grille pitch

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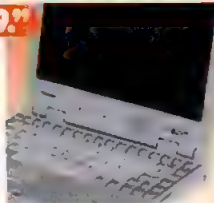
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out among critical tasks in Gantt charts. Unfortunately, PERT calculations for probabilities and duration deviations are not available, and SureTrak is limited to one baseline.

SureTrak includes SBL (SoftBridge Basic Language), a structured version of the programming language BASIC. The program supports OLE Automation but does not support macro recording.

SureTrak's e-mail and Web publishing capabilities are first-rate. The program supports both MAPI and VIM mail protocols, and an included post-office applet lets you communicate with workers who don't have their own copies of SureTrak. Unlike Microsoft Project 98, SureTrak does not let you automatically update project plans via the Internet. For that, you'll need an add-on, Webster 2.0 (\$1,500 street for six users), which lets team members report the hours they worked on tasks through a Web browser. Finally, SureTrak offers an outstanding Web Publishing Wizard that lets you post multiple project reports to structured Web pages, making it simple to set up a single set of links to all relevant data.

As lieutenant to P3, SureTrak serves its role well. But as a standalone product, SureTrak is outclassed by the current competition.—CS

SureTrak Project Manager 2.0. Street price: \$400. Primavera Systems Inc., Bala Cynwyd, PA; 800-973-1335, 610-667-8600; www.primavera.com. Choose 553 at www.pcmag.com/infolink.

Time Line Solutions Corp.

Time Line

The last time we took a comprehensive look at project management software (April 11, 1995), Time Line Solutions Corp.'s Time Line came out on top. Three years later it remains a strong product, combining sophisticated project-scheduling features with attractive tools for less experienced project planners. In other areas, such as integration, reporting, and collaboration, Time Line 6.5 (\$450 street) has fallen behind the pack.

We were impressed with Time Line's help features. One standout is Guide Line, a separate program that steps you through the planning of a new project. When you're done, Guide Line generates a complete and sophisticated project

schedule ready for fine tuning. The program also provides excellent printed and online documentation.

The central feature of the Time Line user interface is the OverView window. More than just a listing of tasks, OverView is a project outline in which you organize

Time Line's distinctive OverView window gives you a bird's-eye view of a project's elements.

all facets of a project, including creating charts, designing layouts, and managing multiple projects. The OverView really helps illustrate the elements of a project and makes them more accessible.

At its core, Time Line offers robust scheduling features, such as a sophisticated resource-leveling process that can split individual assignments to shift resources to higher-priority tasks. The calendar includes the ability to define work shifts.

Time Line carefully distinguishes between basic project tracking, which watches only that the schedule stays on time, and detailed tracking, in which costs and effort expended are tracked along with the schedule. For example, in Time Line you can track overtime as a measure of extra effort without triggering a delay in the task or affecting a leveling calculation.

From OverView, you can customize views and reports using layouts, formats, and settings. This is a useful feature, but it took us some time to learn how to apply the right options to different projects. Similar customization options are available for data fields. Further customizing can be performed with Symantec BasicScript 2.1, the included programming environment. (Time Line Solutions was formerly a subsidiary of Symantec Corp.)

As for reporting, you can print every view on the screen, use the built-in reports, or work with the bundled copy of Seagate Software's Crystal Reports 4.0. We wish the reporting tools were better integrated with the program.

One critical area in which Time Line falls short is sharing project information. The

Import/Export module is only loosely integrated with the main program, and the process takes several steps. But you can expose Time Line data via ODBC, gener-

ate HTML-based project tables, and export to Corel's Envoy format. The latest version (6.5.4) can send project information via the Web and MAPI-compliant e-mail. We found these features primitive compared with those of Microsoft Project 98, for example.

With solid scheduling, tracking, and resource management tools, Time Line is still a good option for managers who typically do not need to share data. In other areas, time may be passing it by.—NHK

Time Line 6.5. Street price: \$450. Time Line Solutions Corp., Novato, CA; 415-898-1919; www.tlsolutions.com. Choose 554 at www.pcmag.com/infolink.

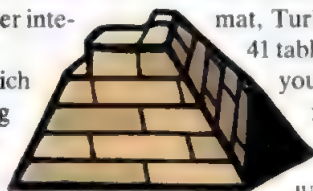
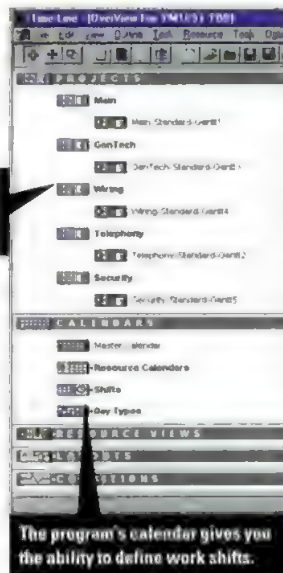
IMSI

TurboProject Professional

The latest version of IMSI's TurboProject Professional (\$300 street), adds database connectivity and vastly improved multi-project management. But the program still lacks some features found in most other programs in this category. For users who can do without these high-end tools, TurboProject Professional's excellent interface and fairly comprehensive project-modeling tools make it a good lower-priced choice. For users with even more basic needs, IMSI offers TurboProject (\$100) and TurboProject Express (\$40).

IMSI has made many updates to TurboProject Professional's interface, achieving a look and feel that resemble those of Microsoft Office. The Project Tree, an expandable and contractible hierarchy that shows project phases, lets you easily navigate through a project. TurboProject Professional includes nine project templates but does not offer a start-up wizard.

For users who like the spreadsheet format, TurboProject Professional has 41 table views. You can also define your own table views, field by field, in a process we found more efficient than those



SUMMARY OF FEATURES

See www.pcmag.com for interactive views!

Project Management Software



■ YES □ NO

CA-SuperProject 4.0

Microsoft Project 98

Project Scheduler 7

SureTrak Project Manager 2.0

Time Line 6.5

TurboProject Professional 2.0

General Features

Street price	\$450	\$500	\$600	\$400	\$450	\$300
Online tutorial	■	■	■	■	■	■
Year 2000-compliant	■	■	■	■	■	■
Project completion constraint	12/31/2129	12/31/2049	12/31/2063	12/31/2069	12/31/2099	Info not available

Project Setup

Wizards or project templates/Task outlining	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Interactive manipulation of tasks and relationships	■	■	■	■	■	■
Maximum number of tasks per project ¹	64,000	Unlimited	99,999	10,000	32,000	32,000
Can schedule recurring tasks/set priorities on tasks	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Effort-driven/Duration-driven tasks	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Supports Work Breakdown Structure (WBS)	■	■	■	■	■	■
Durations measured in months/weeks	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Durations measured in days/hours	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■

Tracking and Modification

User can set lead and lag times on constraints	■	■	■	■	■	■
Baseline variances viewable on screen	■	■	■	■	■	■
Tasks and resources can be filtered	■	■	■	■	■	■

Resource Management

Maximum number of resources per project ¹	Unlimited	Unlimited	99,999	Unlimited	Unlimited	Unlimited
Individual calendars for resources	■	■	■	■	■	■
User can assign resources to a percentage of a task	■	■	■	■	■	■
User can define and assign material resources	■	■	■	■	■	■
Can include overtime costs/materials costing	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User-defined cost formulas	■	■	■	■	■	■
Resource leveling (end date is pushed)	■	■	■	■	■	■
Resource smoothing (end date remains the same)	■	■	■	■	■	■
Leveling by date range	■	■	■	■	■	■
Automatic task splitting during leveling	■	■	■	■	■	■
Can show free float/total float/negative slack time	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Resource allocation histograms	■	■	■	■	■	■

Multiple Projects

Maximum number of projects ¹	16,000	1,000	Unlimited	Unlimited	32,000	Unlimited
Automatic consolidation across multiple projects	■	■	■	■	■	■
Projects can have persistent links to other projects	■	■	■	■	■	■
Leveling across projects	■	■	■	■	■	■
Can maintain resource pool for multiple projects	■	■	■	■	■	■

Reporting

Customizable standard reports	■	■	■	■	■	■
Queries can be printed in reports	■	■	■	■	■	■

Workgroup Capabilities

Multiple user access to shared projects	■ 2	■	■ 2	■	■	■ 2
Update of schedule status via e-mail	■	■	■	■	■	■
E-mail distribution of project information	■	■	■	■	■	■
Publish/update project information via the Web	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■

Customization and Integration

Programming language/Macro recording	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User-definable forms/menus/toolbars	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
OLE client/server	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
ODBC support/Database server connectivity	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Technical-support options	Free for 90 days, then \$2 per minute with a \$30 minimum per call or \$100 per year for unlimited support	Free during regular support hours; after hours, \$35 per incident; priority accounts available	Free	Free	Free for 90 days, then \$30 per incident; support plans available	Free for 60 days; Unlimited Premium Support Plan available
Technical-support hours (eastern time)	9:00-7:00 M-F	9:00-9:00 M-F	10:00-8:00 M-F	8:00-7:00 M-F, 9:00-2:00 Sat.	11:00-7:00 M-F	11:00-8:00 M-F

(1) These are theoretical limits. In practice, the program is limited by the system's available RAM.

(2) Via ODBC (Open Database Connectivity).

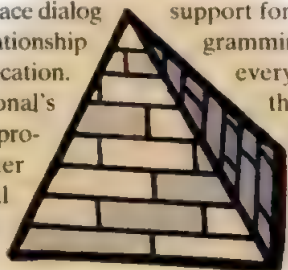
SOFTWARE
Project Management

in the other programs we reviewed.

TurboProject Professional has most of the project-scheduling features you'd expect. Although the resource-leveling function doesn't offer as many options as you'd find in Scitor's Project Scheduler, TurboProject Professional does have a constraining function that will automatically adjust tasks and resources to avoid exceeding an upper limit of expense. One unique feature is the ability to enter activities in a *loose mode*, which lets a manager develop a quick project plan, without having to fill in all the details.

TurboProject Professional provides an excellent Connection Trace dialog, which walks you through a series of relationships, highlighting the links and related data. There is also a similar Profile Trace dialog for walking you through the relationship between costs and resource allocation.

TurboProject Professional's approach to managing multiple projects is simple: Within a master project file, you create special subprojects (each with its own project file) and assign them to

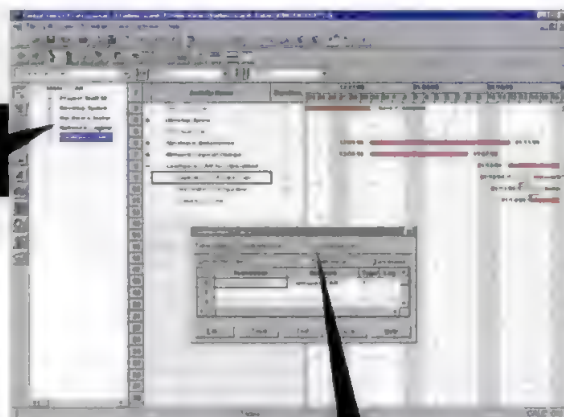


a manager. (The program uses a similar process for project consolidation.) From there, the pro-

TurboProject Professional includes the Project Tree pane, which makes navigating among tasks and subtasks easy.

gram automatically handles distribution and integration of the project data. TurboProject Professional can also share its data via ODBC and distribute project information via e-mail. But its ability to share data is limited by underdeveloped workgroup features and a lack of OLE support.

TurboProject Professional does not have a comprehensive report generator, support for macro recording, or a programming language. Though not every project manager needs these tools, they are often important for customization, especially at the enterprise level. TurboProject Professional does include a runtime version of Seagate



The Connection Trace dialog displays the relationship between a selected task and other tasks.

Software's Crystal Reports.

Despite its "Professional" moniker, this version of TurboProject can't compete with feature-rich programs as an enterprise-level tool. But winning feature wars isn't everything. For many users, TurboProject Professional may fill the bill.—*NHK*

TurboProject Professional 2.0. Street price: \$300. IMSI, San Rafael, CA; 415-257-3000, 800-833-8082; www.turboproject.com. Choose 555 at www.pcmag.com/infolink. **PC**



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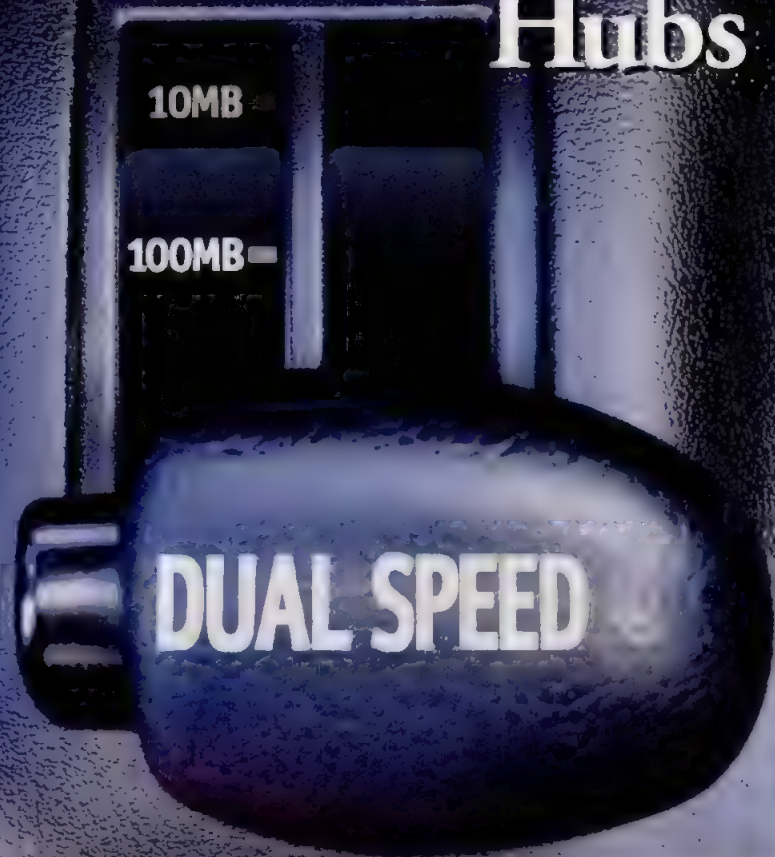
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Net Tools



Street-Smart Switches

More affordable than ever, these 14 auto-sensing 10/100-Mbps switches can speed up a growing workgroup or small network.

By Jeffrey G. Witt

If you've crowded your Ethernet network with legions of users, hearty applications, and lots of new servers but haven't made infrastructure changes, then you've probably noticed a slowdown in performance. One way to get your network humming again is to add a 10/100-Mbps switch that can handle not only your 10-Mbps legacy Ethernet links but fatter 100-Mbps Fast Ethernet connections as well.

Once high-ticket items within reach only of large corporations, 10/100-Mbps auto-sensing

layer-2 switches now cost as little as \$70 per port for unmanaged devices, and \$150 per port for managed ones. In this roundup, we focused on 14 eight-port layer-2 switch products: 6 managed and 8 unmanaged. These make an effective solution for small networks and are suitable workgroup (or even backbone) switches for larger sites. Switches can give more capacity to your server connections or directly to clients running high-bandwidth applications, and they can be used to connect existing Ethernet and Fast Ethernet hubs for better segmentation.

INSIDE

10/100-Mbps Switches

Once only the purview of large networks, these devices speed performance and handle 10-Mbps legacy Ethernet links, as well as 100-Mbps Fast Ethernet connections. But steadily declining pricing is good news for smaller networks looking for a boost to network traffic. PC Magazine Labs tests 14 devices, 6 managed and 8 unmanaged. *Page 225.*



Network Management

Well-known for its hand-held network diagnostic tools, Fluke debuts Network Inspector, a network management application priced in the midrange between low-end network utilities and high-end network management suites. Though contributing editor Steve Rigney found some room for improvement, Fluke's product shows promise. *Page 239.*

IP Management

Rigney also checks out the latest version of Sequel Net Access Manager, a software product that lets you track users on your IP network by DNS name and IP address. *Page 239.*

Internet Tools

Frequent contributor John Garriss shows us how to use Microsoft Active Server Pages (ASP) to speed the development of complex server-side Web applications. *Page 245.*



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Net Tools

10/100 SWITCHES

By nature, Ethernet is a shared medium. Each node sends data packets when it determines that bandwidth is available. There are times when two or more clients may send data simultaneously, resulting in collisions. When collisions occur, the data is retransmitted, resulting in additional network traffic. A hub can't make decisions about where data packets are bound; it merely repeats them to all ports on the hub—creating a single collision domain. And as more clients and bandwidth-hungry applications are added, traffic increases and the bandwidth/performance problem is compounded.

If your network utilization is over 40 percent and your collision rate more than 10 percent, a switch can help. Switches divide each port into a separate segment or collision domain with dedicated bandwidth. Unlike hubs, they look at each data packet and send it to only the appropriate location or segment rather than forwarding it blindly to all ports. The switch collects the actual client addresses and stores them in a table for future reference. Packets with errors or that appear incorrect aren't forwarded, reducing unnecessary traffic. Switches with Fast Ethernet and Ethernet ports can be duplexed, effectively creating dedicated 20-Mbps and 200-Mbps connections.

MANAGED OR UNMANAGED

By now, you may hanker for a switch, but the decisions don't stop there. The next decision, choosing between a managed and an unmanaged switch, is made first and foremost by your pocketbook and second by how complicated your network is. Priced from \$559 to \$1,499, the unmanaged switches reviewed here can work fine for small, relatively flat networks that need to mix Ethernet and Fast Ethernet for better segmentation and specialized applications. Unmanaged switches are no more complicated to install than a 10-Mbps hub. They auto-learn net-

work addresses, and each port can auto-sense the correct speed based on the network adapters you've installed in your PCs.

In environments that need to be managed remotely or in which several switches will be deployed as part of a grander scheme, the more expensive managed products (from \$1,800 to \$2,595) are more desirable. The Windows-based SNMP packages that come with these products permit performance monitoring, generation of alerts, and troubleshooting from a central location of not only the switch but other SNMP devices as well.

The managed products' advanced features include the ability to form VLANs (virtual LANs), found in four of the six managed switches we tested, for minimizing broadcast and multicast traffic. Another feature, the Spanning Tree Algorithm, supported in all of the managed and three of the unmanaged switches, uses redundancy to provide a backup link in case of failure.

SWITCH HITS

We attached all the switches to our test network to evaluate on-board physical features and management and ran them through a battery of performance tests. Two stood out for their features, architecture, and pricing: the Cisco Catalyst 2908XL in the managed switch category and the NetGear FS508 in the unmanaged category.

We found three switching architectures. Except for NetGear's product, all the unmanaged switches and D-Link's and Lannet's managed units were store-and-forward models using Galileo's chip set. *Store-and-forward* means each packet is taken in and inspected before being forwarded.

Switches from Accton, Compaq, NetGear, and SMC all use Accton's chip set, which depends on adaptive cut-through technology.

This method sends data immediately but will also change on the fly to an alternative mode as needed.

Cisco has its own chip set

and deploys a unique shared-memory architecture that avoids having to store data multiple times. This chip set showed the best performance, followed by Accton and Galileo.

If you're looking to speed up your congested network, check out the reviews that follow.

Managed

Accton Fast SwitchHub-8mi

One of the three switches based on Accton's chip set, the Accton SwitchHub-8mi (\$2,199 list) offers admirable performance, competitive pricing, and basic management. This makes it a reasonable buy in the small-VAR or mail-order market. Yet by spending a little more for the Compaq or SMC units, you receive the same hardware as the Accton and better Windows management software.

Physically, the Accton switch is identical to the Compaq and similar to the SMC. All three share the same architecture and text-based configuration/management software, which you can access by connecting through the serial port or remotely via telnet.

For Windows management, Accton provides its own AccView/Open software. Though it has much of the same functionality as the software that comes with the Compaq and SMC models, Accton's interface was lacking in comparison. Compaq in particular has a clearer layout and more intuitive navigation.

The package manages the switch via the SNMP agent running on the device. You can create a graphical network map, perform real-time monitoring, and configure alerts for specific events. As with the Compaq and SMC software, you click on the switch object to get

SUMMARY OF FEATURES

Managed 10/100-Mbps Auto-Sensing Switches

PC MAGAZINE
EDITOR'S CHOICE

■ YES ■ NO	Accton Fast SwitchHub-8mi	Cisco Catalyst 2908XL	Compaq Netelligent 5708TX	D-Link DES-3208	Lannet Visage 800T	SMC Tigerswitch 6608T
List/street price	\$2,199 / \$1,410	\$2,295 / \$1,720	N/A / \$1,580	\$2,499 / \$1,140	\$2,595 / N/A	\$1,800 / \$1,450
Chip-set manufacturer	Accton	Cisco	Accton	Galileo	Galileo	Accton
Enable flow control on a per port basis	■	■	■	■	■	■
802.1d spanning-tree support	■	■	■	■	■	■
Nonblocking cross-bar matrix/PCI backplane	■	■	■	■	■	■
Telnet/Web-based management	■	■	■	■	■	■
RMON/SNMP	■	■	■	■	■	■
Warranty	3 years	1 year	3 years	1 year	1 year	3 years

N/A—Not applicable. The vendor does not cite this price.

a virtual display of the front panel. Clicking on any port or real-time LED lets you check performance and configure parameters such as the Spanning tree or VLANs.

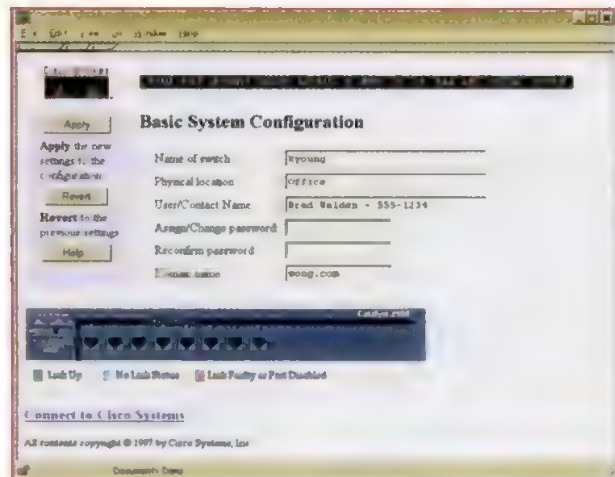
The switch architecture, distinctive from switches based on the Galileo and Cisco chip sets, deploys a nonblocking crossbar matrix switch fabric that handles the theoretical maximum of all ports in full-duplex mode of 1.6 Gbps. The design contributes significantly to superb performance on our X-Stream stress test, permitting packet loss only at extreme load levels. Our Latency test set the switch in a store-and-forward mode, matching Cisco's performance. To alleviate network congestion problems, all the Accton-based switches use back-pressure flow control to guard against packet overflow within the switch.—JGW

Accton Fast SwitchHub-8mi. List price: \$2,199. Accton Technology Corp., Irvine, CA; 408-452-8900; fax, 408-452-8988; www.accton.com. Choose 900 at www.pcmag.com/infolink.

Cisco Catalyst 2908XL



The most complete product in this roundup, the Editors' Choice—winning Cisco Catalyst 2908XL (\$2,295 list) makes a good backbone, or an excellent workgroup, switch. Based on Cisco's own ASIC, the Catalyst includes port aggregation and comes with an internal Webserver for Web-based management; it excelled on our performance tests. You get all these features for the reasonably low price of \$2,295 (list). Missing are expansion ports, alternative media uplinks, VLAN support, and active flow control. This keeps



THROUGH THE CATALYST 2908XL'S internal Web server, you can manage the Cisco switch from any station that is equipped with a Web browser. We found it to be one of the better graphical interfaces in this roundup.

EDITORS' CHOICE

- Cisco Catalyst 2908XL
- NetGear FS508



Any of the switches we tested can serve networks with low-to-average traffic loads. But if you expect heavy network traffic now or in the future, see our Editors'

Choices. Cisco wins as best managed switch; NetGear, as unmanaged.

The Cisco Catalyst 2908XL has practically all the bases covered. First, there's a chip set that is powerful enough to serve in 16- and 24-port switches (and does) as well as an 8-port. Add in a shared-memory architecture and Fast EtherChannel port aggregation, and you get top-notch performance. Cisco's excellent management features include Windows-based SNMP, RMON, and a browser interface. The price

(\$2,295 list) isn't the cheapest, but this package is well worth the cost.

There can be just one standout among unmanaged models—the only one without the limiting Galileo chip set. The NetGear FS508 uses the same Accton chip set found in three of the managed switches, along with adaptive, cut-through forwarding and back-pressure flow control, to outpace even two managed units. Its price (\$1,350 list) is above-average, but given its design and features set, you're buying a higher class of product.

costs down, but if you want to deploy the Catalyst with uplinks to fiber, you may have a problem.

The product differentiates itself from the rest of the switches we reviewed by employing shared-memory switch architecture, in which all ports use the same memory pool to store packets. This eliminates having to store multiple copies of a single frame.

To manage the Catalyst, you can attach a terminal or telnet into the command line interface, Cisco's IOS. The sheer number of configurable features offered by IOS is welcome but can be daunting. The other option is to point your browser at the switch's IP address and use its built-in, Web-based management interface, which we found easy to use. Keep in mind, however, that you don't get the range of features you have with IOS.

Another enterprise-class feature Cisco incorporates is port aggregation. Cisco's implementation, called Fast EtherChannel, lets you combine two to four ports into a single logical port. This means you can create connections with speeds up

to 400 Mbps at half duplex or 800 Mbps at full duplex.

Other features include support for Cisco's Group Management Protocol (CGMP) and broadcast storm control. CGMP lets the Catalyst determine which ports are part of multicast groups and forward packets only to the appropriate ports. The unit has an embedded agent that lets you monitor four RMON groups.—Kevin Young

Cisco Catalyst 2908XL. List price: \$2,295. Cisco Systems, San Jose, CA; 800-553-6387, 408-526-4000; www.cisco.com. Choose 901 at www.pcmag.com/infolink.

Compaq Netelligent 5708TX

The Compaq Netelligent 5708TX (\$1,580 street) bundles the Accton architecture with Compaq's own Netelligent Management software (CNMS). This software is superior to that of the Accton and SMC switches, which are also based on the Accton chip set. But for the ultimate in performance and feature set, the Cisco Catalyst 2908XL switch is the superior buy.

Physically, the Netelligent is indistinguishable from the Accton Fast SwitchHub-8mi and produces comparable performance. The switch's combined throughput of 1.6 Gbps and adaptive packet forwarding contributed directly to high performance on our tests.

For configuration and management, you get

your choice of the Configure button on the front, a terminal interface, or the Windows-based CNMS. Using the Configure option, you can set port operation and display specific activity such as bandwidth utilization and packet filtering. With the serial port or telnet, you can set VLANs, Spanning Tree capabilities, and SNMP configurations. Performance and status statistics are clearly displayed.

Though similar to the Accton and SMC units, the SNMP-based CNMS is more elegant. We liked its ability to locate all the devices on our test network—including a router, switches, and a number of client machines, plus NetWare and Windows NT servers—by subnet. And we could quickly drag and drop objects to create a topology map. If you connect devices inappropriately, the software will notify you, a feature we didn't find in the Accton or SMC units. The software doesn't offer the same drag-and-drop functionality as Lannet's for configuring multiple ports, but the Lannet software is pricey.

If your site already deploys Compaq's large-scale Insight Manager, which ships with the vendor's servers, CNMS will snap in to create a single management platform.—JGW

Compaq Netelligent 5708TX. Street price: \$1,580. Compaq Computer Corp., Houston, TX; 800-345-1518, fax 281-518-1442; www.compaq.com. Choose 902 at www.pcmag.com/infolink.

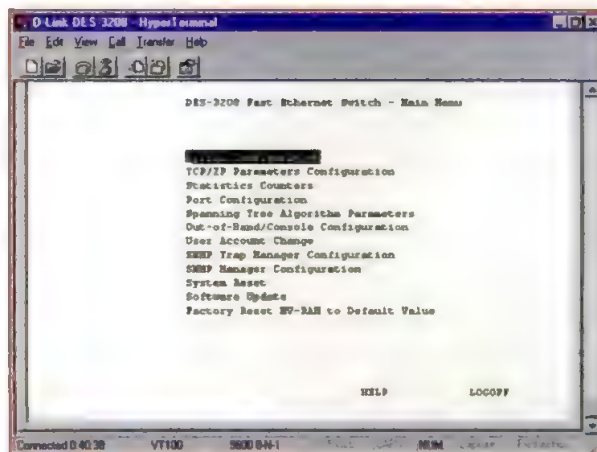
D-Link DES-3208

If you are considering implementing SNMP on your low-traffic workgroup or backbone switch and don't need many other features—except an MII port and free, lifetime technical support—then the D-Link DES-3208 (\$2,499 list) may be worth a look. Unfortunately, the DES-3208 had the slowest performance of the bunch. Although the product has the same Galileo chip set as its sibling (the unmanaged eight-port DES-

1008) and most of the other unmanaged switches, those models outperform the DES-3208 across the board. Furthermore, there is no dedicated CPU for management as in the other managed switches; the switching engine ASIC performs these tasks, leaving it less able to handle heavy loads. The DES-3208 had a high forwarding latency for all packet sizes tested.

On its Web site, D-Link claims the DES-3208 supports VLANs but told us you won't be able to implement port-based VLANs until the third quarter of 1998. D-Link also claims that the product lets an administrator control IP multicasts and broadcasts, but we could not find a way to use this feature.

Where the DES-3208 distinguishes itself is in its MII port (separate from the uplink feature). The Fast Ethernet equivalent of an AUI port, it



THE D-LINK DES 3208's menu-driven interface allows you to perform basic management functions, but it lacks the functionality of an HTML-based browser and left us wanting more.

disables port 2 when used and is handy for connecting to any type of media such as fiber.

The DES-3208 also has an easy-to-use con-

nect to auto-negotiate speed and duplex. You can also look at statistics on a per-port basis, such as the number of transmitted and received packets, the size of the packets, and the number of bad packets. The switch supports four groups of RMON, which can be helpful for more advanced traffic analysis and network trending.

You can get this same information from the DES-3208's SNMP capabilities. Assign it an IP number and the IP number of the SNMP management station, and you are able to view all of these statistics graphically.

—Brad Walden

D-Link DES-3208. List price: \$2,499. D-Link Systems Inc., Irvine, CA; 800-326-1688; www.dlink.com. Choose 903 at www.pcmag.com/infolink.

Lannet Visage 800T

One of two Galileo-based managed switches in our roundup, the Lannet Visage 800T (\$2,595 list) offers several unique features including an external backplane and a proprietary management scheme called SMON. The downside is that most of these features come at an additional expense, and with only a 4MB buffer and a Galileo chip set, the Visage's performance was relatively poor. Its most interesting feature is a 4-gigabit

external backplane option (\$395 list), called the Exoplane. Through a proprietary connector, up to four devices can be connected,

SUMMARY OF FEATURES

Unmanaged 10/100-Mbps Auto-Sensing Switches

	Adtron AES-800TX	Allied Telesys CentreCOM AT-FS708	Asanté FriendlyNET FS4008DS	Cisco 1548	D-Link DES-1008	Farallon Fast Starlet Switch	LinkSys EZXS88	NetGear FS508
■ YES ■ NO								
List/street price	\$1,379 / N/A	\$995 / N/A	\$559 / N/A	\$1,295 / \$970	\$1,499 / \$930	N/A / \$1,300	\$1,119 / \$740	\$1,350 / \$1,000
Chip-set manufacturer	Galileo	Galileo	Galileo	Galileo	Galileo	Galileo	Galileo	Accton
Flow control	■	■	■	■	■	■	■	■
802.1d spanning-tree support	■	■	■	■	■	■	■	■
Buffer size	4MB	4MB	8MB	4MB	8MB	4MB	4MB	768K
Cut-through/Store-and-forward	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Nonblocking cross-bar matrix/PCI backplane	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Warranty	Lifetime	5 years	Lifetime	1 year	Lifetime	3 years	5 years	5 years

N/A—Not applicable. The vendor does not cite this price.

8:02 a.m. Installed network.
8:59 a.m. Connected with staff.
(In more ways than one.)



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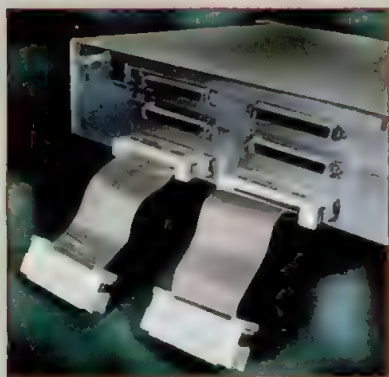
Net Tools

10/100 SWITCHES

forming a single logical stack. This lets you easily scale to meet your needs as you grow.

Rather than being built into the box, as it is with the other managed switches, Lannet's management comes as an optional card called the Visage NMA (\$995 list). This card fits into the Lannet's stacking scheme, so you have to purchase only one card for an entire stack of switches. Once in place, the NMA can be accessed by direct PC connection or telnet.

The Lannet's NMA uses an Intel i960 processor to carry out its management func-



THE 4Gb EXOPLANE lets you stack up to four Visage network switches into one logical unit.

tions, which helped the Visage perform better than D-Link's DES-3208 and only slightly worse than the unmanaged Galileo switches.

To do even basic configuration, you need Lannet's management software, Montage (\$1,795 list). Currently, it runs on Windows 95 and will run on Windows NT soon. From a graphical depiction of the switch's panel, you can select a port and configure its speed, duplex, flow control, and other characteristics. We could also configure up to 255 VLANs. We liked the GUI interface, but keep in mind that the Visage has no console or telnet management capability.

As an alternative to Montage, you can purchase Montage Plus (\$3,495) which lets you add Lannet's Switch Monitoring Application (SMON) to your stack. With SMON you can monitor traffic on every SMON-licensed switch (\$995 list per stack) in your network.—KY

Lannet Visage 800T. List price: \$2,595. Lannet, Los Gatos, CA; 408-871-4000; www.lannet.com. Choose 904 at www.pcmag.com/infolink.

SMC TigerSwitch 100

The SMC TigerSwitch 100 (\$1,800 list) offers performance similar to the other two Accton-

based switches in this roundup. It also comes with Windows-based management software and a built-in connection for adding a redundant power supply. Though the TigerSwitch does the job, we preferred Accton's and Compaq's management implementations.

The switching engine, using Accton's chip set, has a nonblocking crossbar design, permitting 1.6-Gbps aggregate throughput that resulted in great performance across both tests bested only by Cisco's switch.

Like the Accton and the Compaq products, the SMC furnishes an array of LEDs with a front-panel configuration button. The design takes management-at-a-glance to its highest level, as the LED panel is the most comprehensive of any we reviewed here. The panel shows not only the status of all eight ports with transmit/receive, 100-Mbps speed, duplex modes, and link status, but also displays forwarding, utilization, and collision percentages for individual ports. Using the configuration button, we could check each display mode and interactively change the communication setting to auto-negotiate full or half duplex.

Interconnections with other switches, as with Cisco's and D-Link's units, are via an additional uplink port, which precludes using the eighth port—a less desirable route than Lannet's stacking technique.

Management through the serial port or telnet is exactly like that of the Accton's Fast SwitchHub and Compaq's text-menu console. The Windows management software, EliteView, is downloadable free from SMC's Web site, using a password included with the unit. EliteView communicates directly with the switch's SNMP MIBS. As with the Accton AccView package, you lose some management functionality if you use Windows 95, which lacks raw packet support. You'll be better served using Windows NT 4.0 or a third-party TCP/IP stack with Windows 95.—JGW

SMC TigerSwitch 100. List price: \$1,800. SMC Networks Inc., Hauppauge, NY; 800-762-4968, fax 516-273-1803, www.smc.com. Choose 905 at www.pcmag.com/infolink.

Unmanaged

Addtron AES-800TX

The Addtron AES-800TX (\$1,379 list) is designed for small- to medium-size companies and corporate workgroups. We were surprised to find that Addtron markets the switch as both a workgroup and a backbone

solution, since it comes with only a 4MB buffer—a potential problem for busy networks. And it does not support flow control.

Performance was comparable to that of the other Galileo-based units, with lots of packet loss at high network loads and with poor Latency scores.

The AES-800TX has the same design as the ATI and Farallon switches. Addtron Technology is the OEM. The AES-800TX's front panel has LEDs for monitoring speed, duplex mode, link, activity, and collisions. As with most of the unmanaged units, its eighth port can also be used as an uplink connection via a push button located alongside.

Like Asanté and D-Link, Addtron offers free, lifetime support and a limited lifetime warranty.—Martin Wong

Addtron AES-800TX. List price: \$1,379. Addtron Technology Co. Ltd., Fremont, CA; 888-233-8766; www.addtron.com. Choose 906 at www.pcmag.com/infolink.

ATI CentreCOM AT-FS708

Although it's more expensive than the Asanté FriendlyNET FS40008DS, the ATI CentreCOM AT-FS708 (\$995 list) is one of the lowest-priced products in this roundup. Unlike Addtron, which markets essentially the same switch for both backbone and desktop use, Allied Telesyn targets workgroups only. In addition to low pricing, you also get a five-year warranty and free, lifetime technical support. Identical to Farallon's Fast Starlet as well, the ATI CentreCOM AT-FS708 uses the Galileo chip set and comes with a 4MB buffer and uplink capability via the eighth port. The ATI also offers five LEDs per port.

As with all the Galileo-based switches, performance was less than ideal—with lots of dropped packets at high network loads and high latency. If your main reason for upgrading to 100-Mbps switching is to relieve the load on one or two highly congested ports, the ATI's 4MB buffer could quickly overflow and lose packets. But for speeding up a workgroup or peer-to-peer transfers, the buffers will matter less—making the ATI better for your needs.

Of the three vendors selling this same switch, ATI was the only one to add heat sinks to its chips, cutting the odds that chips will overheat.—KY

ATI CentreCOM AT-FS708. List price: \$995. Allied Telesyn International, Sunnyvale, CA; 408-730-0950; www.alliedtelesyn.com. Choose 907 at www.pcmag.com/infolink.

10/100-Mbps Switches



The Cisco Catalyst 2908XL and the NetGear FS508 were the performance leaders. With its Accton chip set, the NetGear FS508 outpaced the other unmanaged switches. The Cisco, with a proprietary chip set, was the best of the bunch.

What the Numbers Mean

Our benchmark test results divide the products into three classes based on ASICs (application-specific integrated circuits). The Galileo Technology-based products had the poorest performance. The Accton Technology chip set, found in the NetGear, was the clear winner in the unmanaged class. The third chip set, by Cisco Systems, is unique to its products and was at the top of the class.

The two sets of results reflect opposite ends of the performance spectrum. The X-Stream test is a pure stress test, whereas the Latency test sends a single broadcast packet and measures the time it takes that packet to traverse the switch. If you plan to deploy your switch in a high-traffic environment, you should choose one that performed well on the X-Stream test. For less loaded networks, latency is more relevant.

The Galileo's design shortcoming is its oversubscription of the backplane. There is insufficient bandwidth (1.056 Gbps) to handle the 1.6-Gbps full-duplex traffic eight ports can produce. At network loads over 40 percent, this resulted in significant packet loss. That should not be a problem for networks with average traffic conditions, but if your network has or expects heavy traffic, go for the similarly priced Accton-based units.

The most lackluster performance came from the Galileo-based D-Link DES-3208 and the Lannet Visage 800T, thanks to both the chip set and management overhead. The D-Link suffers for its lack of a separate management CPU, whereas the Lannet offsets this somewhat by including an Intel i960.

The Accton-based switches' nonblocking crossbar matrix

design dedicates a single internal connection from each port to every other port. This contrasts with a Galileo bus architecture, in which packets headed for different ports must compete on the single bus connection. With its shared memory architecture, the Cisco Catalyst 2908XL handled everything we threw at it.

How We Tested

Our primary testing tool was Netcom System's SmartBits—a chassis device that contains up to 20 modules that can generate Fast Ethernet wire-speed traffic (148,810 packets per second). Our two charts come from tests in the Advanced Switch Test (AST) suite. The X-Stream Frame Loss test sends traffic from each port to all seven other ports on the switch at various loads. We ran these tests in full-duplex mode, so at a 100 percent load, each port sends 100 Mbps and receives 100 Mbps.

We used the Broadcast Frames test within AST to perform our Switch Broadcast Latency test. This simply measures the length of time it takes a packet to go from the sending station to the receiving station. In our case, we measured the amount of time it took a broadcast packet to cross the switch.—*Analysis written by Jeffrey G. Witt*

SWITCH BROADCAST LATENCY (microseconds)

Low scores are best. Bold type denotes first place.	Frame size		
	64 bytes	256 bytes	1,518 bytes
Accton Fast SwitchHub-8mi	14	29	130
Addtron AES-800TX	17	40	189
Allied Telesyn AT-FS708	22	40	188
Asanté FS4008DS	17	40	188
Cisco 1548 Micro Switch	17	40	188
Cisco Catalyst 2908XL	16	31	132
Compaq Netelligent 5708TX	14	29	130
D-Link DES-1008	17	40	188
D-Link DES-3208	21	56	263
Farallon Fast Starlet Switch	17	44	189
Lannet Visage 800T	18	42	198
Linksys EZXS88	17	40	189
NetGear FS508	14	29	130
SMC TigerSwitch 100	13	29	130

X-STREAM FRAME LOSS (percentage of packets lost)

Low scores are best. ○—No frames lost (perfect score).	80 percent load			80 percent load			100 percent load		
	64 bytes	256 bytes	1,518 bytes	64 bytes	256 bytes	1,518 bytes	64 bytes	256 bytes	1,518 bytes
Accton Fast SwitchHub-8mi	○	○	○	○	○	○	27.2	26.9	26.7
Addtron AES-800TX	○	○	○	22.1	12.0	12.0	38.2	32.5	33.5
Allied Telesyn CentreCOM AT-FS708	○	○	○	22.1	12.0	12.0	38.2	32.5	33.5
Asanté FriendlyNET FS4008DS	○	○	○	23.7	12.1	11.0	39.1	32.2	33.1
Cisco 1548 Micro Switch	○	○	○	21.3	10.5	10.3	37.5	31.1	32.2
Cisco Catalyst 2908XL	○	○	○	○	○	○	○	○	○
Compaq Netelligent 5708TX	○	○	○	○	○	○	28.1	28.2	27.1
D-Link DES-1008	○	○	○	23.5	11.9	10.4	39.0	32.1	32.9
D-Link DES-3208	41.8	22.5	12.5	56.5	41.9	34.5	65.2	54.0	48.4
Farallon Fast Starlet Switch 10/100	○	○	○	22.1	12.0	12.0	38.2	32.5	33.5
Lannet Visage 800T	6.5	0.1	○	29.5	22.0	23.2	44.3	40.5	41.6
Linksys EZXS88	○	○	○	22.1	11.9	11.8	38.2	32.3	33.3
NetGear FS508	○	○	○	< 0.1	○	○	27.5	27.1	26.7
SMC TigerSwitch 100	○	○	○	○	○	○	28.1	28.2	27.1

None of the switches suffered packet loss at a 40 percent network load except for the D-Link DES-3208, which suffered an 11.7 percent loss with a 64-byte frame.

Asanté FriendlyNET FS40008DS

The Asanté FriendlyNET FS40008DS (\$559 list) comes with a few extras for the small workgroup network to which it's marketed. Among these features are 8MB of shared RAM



THE DIP SWITCHES on the Asanté switch let you force individual ports into 10-Mbps, half-duplex operation.

buffer—five of the other six Galileo-based units offer half that—plus eight DIP switches on the back. The DIP switches can be used to suppress NWay auto-negotiation, forcing 10-Mbps, half-duplex operation on a per-port basis.

Performance was comparable with that of other Galileo-based switches. Packet loss was high at higher network loads and latency was higher than switches based on the Accton and Cisco chip sets.

LEDs in front indicate operational modes—four per port—and port 1 can double as an uplink. Asanté's lifetime warranty and free, lifetime technical support are more generous than those of the more expensive Cisco and Farallon products.

If you want to increase your network performance while going easy on your wallet, check out the FriendlyNET.—*BW*

Asanté FriendlyNET FS40008DS. List price: \$559. Asanté Technologies Inc., San Jose, CA; 800-662-9686; www.asante.com. Choose 908 at www.pcmag.com/infolink.com.

Cisco 1548 Micro Switch

If you want round-the-clock support, exceptional documentation, and the peace of mind that comes from going with an established vendor, look to the Cisco 1548 Micro Switch (\$1,295 list). Unfortunately, the big name belies a few flaws, such as a one-year warranty (compared to lifetime warranties for the Addtron, Asanté, and D-Link products) and only 4MB of buffer RAM. Other than the buffer, the Cisco 1548 is nearly identical in-

ternally to the six other unmanaged Galileo chip set-based switches in this roundup and showed similar, less-than-perfect performance at high network loads.

Externally, it has a slightly different layout, with rear-based ports—offering no uplink capability—and LEDs on both the back and front. This can be annoying if the switch is deployed as a standalone device. But the Cisco 1548 avoids this problem when used as a part of the Cisco Networked Office stacking family product line. These basic network building blocks can be stacked to offer a convenient network-device tower that fits snugly in a small office space.—*KY*

Cisco 1548 Micro Switch. List price: \$1,295. Cisco Systems Inc., San Jose, CA; 800-553-6387, 408-526-4000; www.cisco.com. Choose 901 at www.pcmag.com/infolink.

D-Link DES-1008

Of the unmanaged switches in this roundup, the D-Link DES-1008 (\$1,499 list) comes up at the high end. For the switch's intended market of workgroups and small- to medium-size networks, the benefits include 8MB of shared buffer RAM (the same amount you'll find in the cheaper yet capable Asanté model) and a lifetime warranty available from Addtron as well as Asanté.

The DES-1008, like all of the other unmanaged switches besides NetGear's, is based on the Galileo chip set and turns in performance that is roughly equal to those of the other Galileo-based units. Packet loss was high at network loads of 80 to 100 percent, and latency was higher than it was with switches based on Accton and Cisco chip sets. Four LEDs per port are positioned off



THE CISCO 1548 Micro Switch has ports on the back, but link status LEDs on the front can make checking tedious.

Net Tools

10/100 SWITCHES

to the side, and port 1 serves as an uplink.

If you're in the market for a 10/100-Mbps switch and don't mind the high

price, the DES-1008 is worth a look. But you'll get a better deal with our Editors' Choice-winning NetGear FS508.—*BW*

D-Link DES-1008. List price: \$1,499. D-Link Systems Inc., Irvine, CA; 800-326-1688; www.dlink.com. Choose 903 at www.pcmag.com/infolink.

Farallon Fast Starlet Switch 10/100

Offering a free consulting and configuration service, Farallon makes its Fast Starlet Switch 10/100 stand out from the crop of unmanaged switches such as the Addtron and ATI models, which are virtually identical. (It is Addtron's design, right down to the LEDs.) But you'll need to balance the value of these services against an above-average, \$1,299 list price and the Galileo chip set and 4MB buffer found in the same-source models. As with all the Galileo-based products, the Fast Starlet was poor in performance when network utilization was high. What's more, you can do better than Farallon's three-year warranty. Asante and D-Link offer lifetime warranties, and the NetGear and Linksys warranties last for five years.

If you have neither the time nor the expertise to diagnose a network-performance problem, the Dr. Farallon Performance Clinic (available to all network administrators, not merely Farallon customers) is comprised of a network profile sheet you fill out; a phone consultation then follows. This value-add is especially suited for the vendor's target markets: educational sites and small networks running high-bandwidth applications.—*JW*

Farallon Fast Starlet Switch 10/100. List price: \$1,299. Farallon Communications Inc., Alameda, CA; 510-814-5000; fax, 510-814-5020; www.farallon.com. Choose 909 at www.pcmag.com/infolink.

Linksys EtherFast EZXS88

If your network traffic doesn't mandate more than 4MB of buffer RAM, take a look at the Linksys EtherFast EZXS88 (\$1,119 list). Geared toward small businesses, workgroups, and SOHO networks, the EtherFast EZXS88 is moderately priced and comes with a generous warranty.

As with most of the unmanaged switches we reviewed, the Ether Fast EZXS88 uses the Galileo chip set, and its performance was typ-

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ical of the architecture—with high packet loss at heavy network loads. This should be a problem only in environments with heavy network traffic. Individual LEDs next to each port make it easy to view status and activity. As with the Cisco product, however, there's no MDI port provided. You'll need a crossover cable to uplink the switch.

Linksys, primarily known for hubs and NICs, provides free, lifetime technical support and a five-year warranty. Setting up the switch was easy, despite the fact that little documentation was included in the box.—MW

Linksys EtherFast EZXS88. List price: \$1,119. Linksys Inc., Irvine, CA; 714-261-1288; www.linksys.com. Choose 910 at www.pcmag.com/infolink.

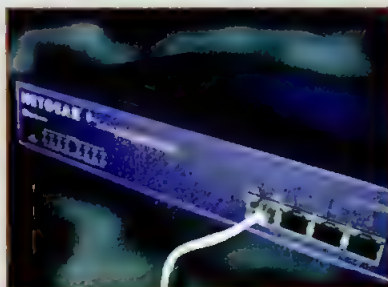
NetGear FS508



The NetGear FS508 provides high performance through its exceptional switching architecture, earning it an Editors' Choice. Though above-average in price (\$1,350 list), this product beat out the other unmanaged units we reviewed—without the need for any buffer RAM. On our SmartBits

X-Stream test, for instance, the NetGear lost packets under only a 100-percent load; the Galileo-based units, by comparison, suffered losses at 80 percent. Latency scores were also considerably lower than those of the switches based on the Galileo chip set.

If you are purchasing a switch to reduce congestion on a few ports or if you anticipate heavy network traffic at some time in the future, then the NetGear FS508 is the switch for you.



NETGEAR FS508 HAS excellent per-port LEDs that let you easily check the link status and duplex mode.

Net Tools

10/100 SWITCHES

The NetGear uses the same chip set and architecture—a nonblocking crossbar matrix found in some of the managed switches—

for less cost. One difference is the NetGear's adaptive forwarding method. Initially set to cut-through mode for faster performance at low network utilization, it automatically switches to store-and-forward as traffic flow and collisions increase. The NetGear also includes flow control but doesn't support spanning trees as do some of the other products.

Monitoring is relatively easy. Link-status and duplex-mode LEDs are located directly on each port, whereas speed and utilization LEDs are grouped to the left of the front panel. DIP switches on the back let you force full-duplex operation, and the eighth port permits uplinks.

The NetGear's added performance justifies its price tag. Included, too, are lifetime, round-the-clock technical support and a five-year warranty.—MW

NetGear FS508. List price: \$1,350. NetGear Inc., San Jose, CA; 408-988-2400, 888-638-4327; netgear.baynetworks.com. Choose 911 at www.pcmag.com/infolink.

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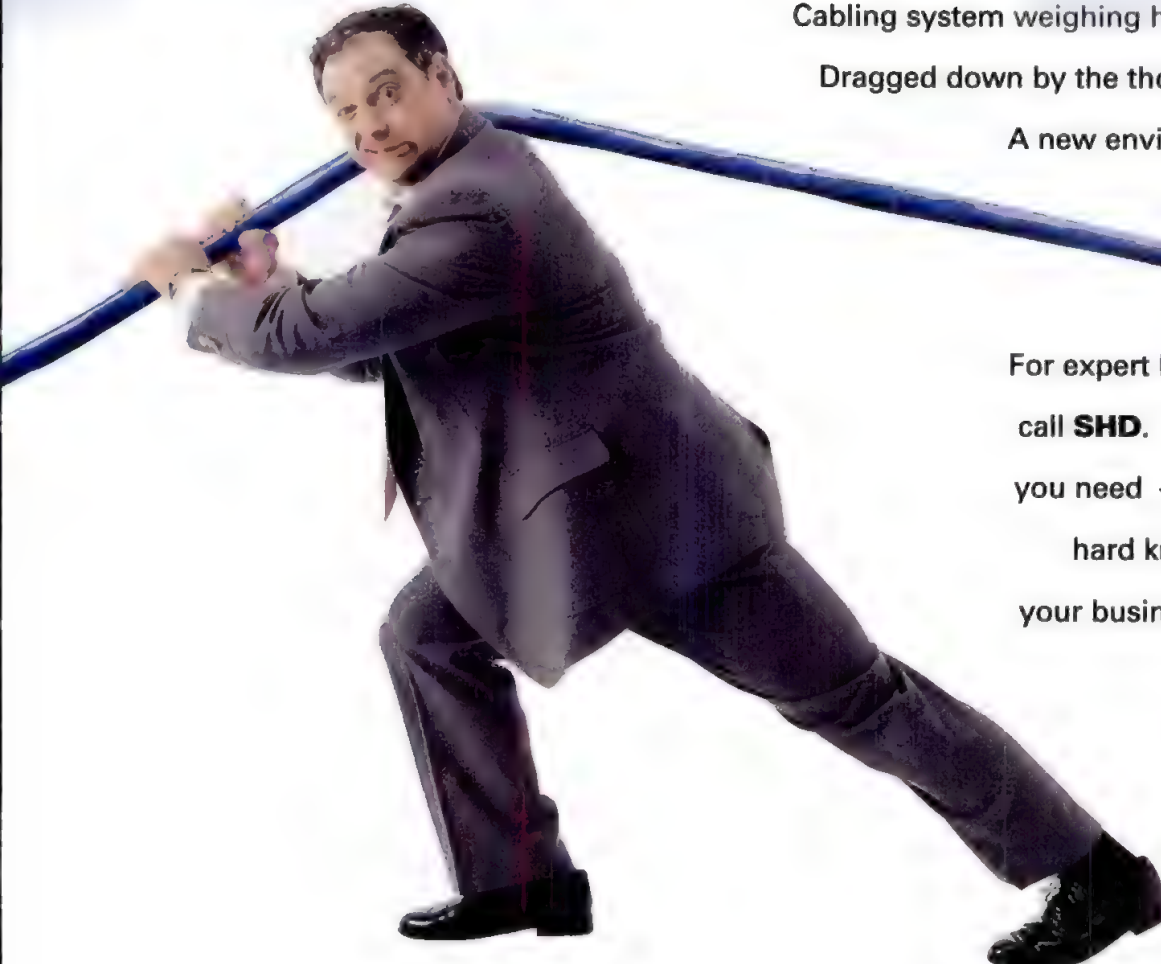
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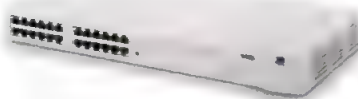
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FROM THE BENCH

NETWORK MANAGEMENT

An Administrative Gumshoe

By Steve Rigney

Best known for its hand-held network diagnostic tools, Fluke Corp. is entering new territory with its software-based network management solution, Network Inspector 2.1. With this version (the first release of the product), Fluke is trying to open a new market niche between the small standalone utilities, which are available for a few hundred dollars, and the high-end network management suites that can run tens of thousands of dollars.

on our network, and it also provided inaccurate data.

The product consists of two software components, the agent (100-node license, \$495 list) and the administrative console (\$395). The agent application gathers data from your network and stores it locally in a third-party ODBC database. The console application lets you see the stored data. Both elements need to be loaded on a Pentium-class system with 32MB of memory and 10MB of disk space, running Microsoft

across the wire. On our five-server test-bed, the product discovered all the network nodes almost immediately. On larger and more complex networks, the process takes longer.

During testing, we found a serious shortcoming in how Network Inspector identifies servers on a network. The product looks for specific network services such as BootP, DHCP, DNS, OSPF, and RIP. If your servers are not running these services, Network Inspector will not recognize the servers as servers. Of our three Windows NT servers, only the one running DHCP was listed as a server on the administrative console. The two file-and-print servers did appear under the console's IP device listing. Fluke plans to remedy this problem by adding detection of more services in the future.

Network Inspector incorrectly reported the number of connections to our NetWare 4.11 server, as well as the license type. Instead of listing 10 connections and a 50-user license, the product detected a single connection and no license. Fluke claims that this is the result of NetWare Directory Service's design, which prevents the product from broadcasting this information.

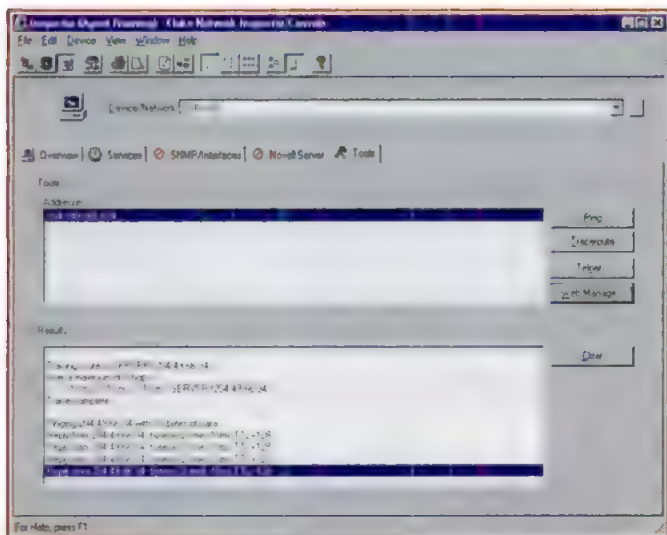
After we got past the discovery issues, Network Inspector presented several features we liked. When you bring up the console you can view a list of all your PCs,

IPX segments, IP subnets, servers, hosts, and NetBIOS domains, as well as the SNMP-enabled devices on your network. You can drill down on a device to view detailed information, such as the device type, the IP or MAC address, and the node's condition. The product also provides a few useful options based on the services and protocols running on the node. When we selected a server running IP, we were able to run ping, telnet, and TraceRoute without leaving the application.

The console places an alarm icon besides any network device with a problem. Clicking on the alarm icon gives you a description of the problem. Furthermore, when you select the help option in the window, Network Inspector presents you with the definition of the problem and how to fix it, then lets you know if the problem is damaging your network.

Although the initial release of Network Inspector is wanting, Fluke is on the right track in trying to provide a complete network management application below the thousand-dollar price point. We look forward to future releases of Network Inspector.

Network Inspector 2.1. List price: Console, \$395; 100-node agent license, \$495. Fluke Corp., Everett, WA; 800-443-5853, 425-347-6100; fax, 425-356-5116; www.fluke.com. Choose 920 at www.pcmag.com/infolink.



FOLLOW THAT PACKET: Network Inspector lets you use TraceRoute and ping network nodes without leaving the application.

The product has the trappings of a very promising solution. We liked its Windows Explorer-like interface, which displays status information on your network devices at a glance, and the product's ability to detect, notify, and offer solutions for various network errors. But Network Inspector had difficulty recognizing a few servers

Windows 95 or Windows NT. You have to deploy only a single agent per network segment.

Unlike other products that discover and monitor your network by continuously pinging all the network devices, Network Inspector conserves bandwidth by listening to the protocol and the network service traffic traveling

IP MANAGEMENT

We Know Who You Are

By Steve Rigney

Although most firewalls and proxy servers record IP traffic, searching the log files to find out what your users are doing is a difficult job. And if you're using BootP or DHCP, which assign IP addresses dynamically, it is nearly impossible. Sequel Technology's Sequel Net Access Manager 4.0 (SNAM) lets you monitor IP traffic by the IP address or the DNS user name, which makes the product a useful tool for monitoring how employees use the

corporate Internet connection.

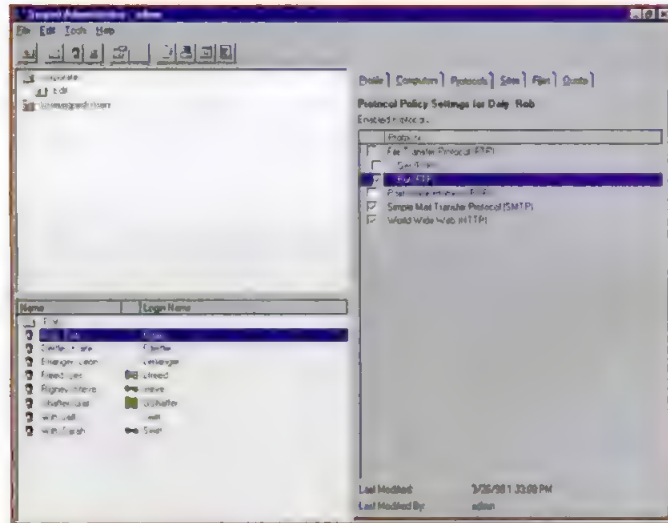
You can control your users' access to various Internet protocols as well. This functionality is expensive, though. A 100-user license lists for \$3,995, and the product also requires Microsoft SQL Server 6.5 or Oracle Server 7.3.

SNAM sits between your network and the Internet connection and monitors and records the IP traffic that passes and records it into the database. The product requires a Microsoft Windows NT server with a Pen-

tium-class processor, 32MB of RAM, and 1GB of disk space. Installing SNAM on our Compaq ProLiant 1500 with dual Pentium/133 processors and 128MB of RAM was fairly painless, but we recommend that you read the manual before you

begin. The installation wizard includes a numbered menu that walks you through the setup of all components.

After installation, we were immediately able to view some of the dozen or so premade reports that display network volume per



CONTROL THE FLOW: Sequel Net Access Manager's control option lets you determine which Internet protocols your users can access.



hour, network usage per protocol, and network usage per IP address or host name. We especially liked the volume reports, because they helped us determine the busiest times of the day for Internet usage. The usage-by-protocol report is another good way to determine which services people are accessing. For example, we were able to see when a user launched a RealAudio session and how much network bandwidth the connection consumed.

One of the handy features of SNAM is its ability to tell you who is generating traffic on your network. SNAM tracks individuals by their DNS user names and their IP addresses using its Sequel Naming Service Agents, which are available for NetWare and Windows NT. This enables you to track people who log in on differ-

ent machines or use multiple systems simultaneously.

We installed SNAM on our Windows NT domain controller and saw detailed information, also based on user names and IP addresses. For those whose networks do not have NetWare or Windows NT servers, Sequel provides a DOS-based utility that can be loaded on each user's PC to provide the same function as the agent.

If you want to control which protocols and services users can access, you can install the active-filtering option (\$795) on PCs throughout your network. Using this option, we set up SNAM to let only the administrators use FTP but allow HTTP access to all of our users.

Sequel Net Access Manager 4.0. List price: 100-user license, \$3,995. Sequel Technology, Bellevue, WA; 800-881-2465, 425-556-4000; fax, 425-646-6556; www.sequeltech.com. Choose 921 at www.pcmag.com/infolink. **PC**

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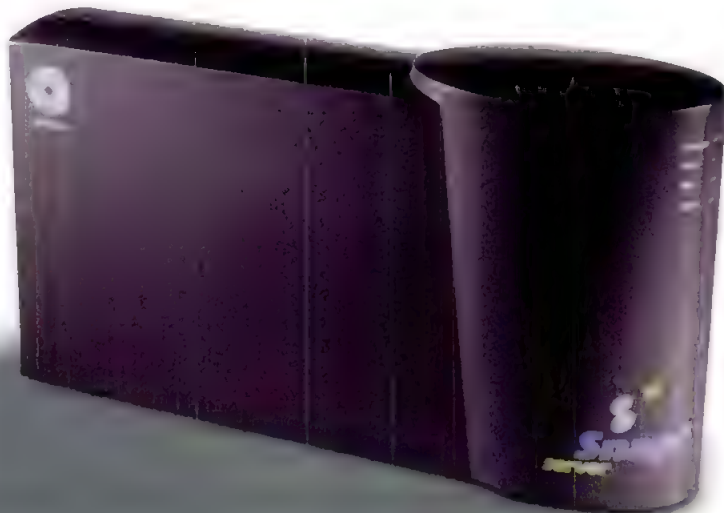
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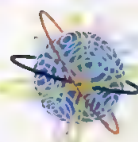
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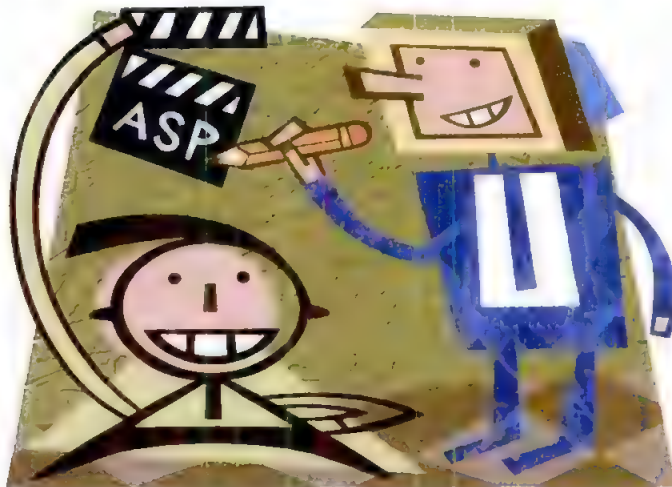
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Scripting with ASP



By John Garriss

One of the well-known problems of Web applications development is that the Web's underlying protocol, HTTP, and its markup language, HTML, weren't designed to handle complex application logic. Traditional *HTML authoring tools*, such as NetObjects Fusion and Macromedia Dreamweaver, are great for document publishing and simple Web sites, but they don't address the issue of server-side Web applications development.

Microsoft Active Server Pages (ASP) was designed specifically to simplify the process of developing Web applications. Built into Internet Information Server (IIS) Version 3.0 and later, ASP provides an easy-to-learn scripting interface along with a number of predefined objects that simplify many development tasks—such as maintaining user state and defining global variables within an application. You can also use ActiveX components to perform

additional functions, among them accessing ODBC databases and outputting data to text files.

ASP is similar in concept to Allaire's Cold Fusion and Netscape's server-side JavaScript, and it is designed as a convenient alternative to conventional CGI scripting

using Perl or C scripts. It's a great fit for a wide array of workgroup applications, including online human resources and accounting applications.

HOW IT WORKS

When you create an ASP application, you create ASP script files: plain text files comprising a combination of standard HTML code and script commands. While Web servers normally send HTML files directly to the client's Web browser in response to HTTP requests, IIS first processes the content of ASP scripts before sending output to clients. Within an ASP script, standard HTML code is sent directly to the browser, while script commands are executed locally on the Web server.

Figure 1 is an example of a simple ASP file. Note the two `<%...%>` code fragments in the above text. This syntax indicates ASP commands that are interpreted at the server instead of being passed to the client. The first line tells the ASP engine to process the script using the VBScript interpreter. The second line of code, `<%Response.Write Now%>`, instructs the ASP engine to output the current date and time to

the client's browser.

Within the client browser, the downloaded source page appears as shown in Figure 2. ASP is implemented as an ISAPI application integrated into IIS. As a result, ASP doesn't incur the performance overhead common to CGI applications, which spawn individual processes for every new request that goes through the Web server.

With ASP, a single ISAPI process handles all ASP requests. Furthermore, with IIS 4.0, ASP can be run out-of-process from IIS, meaning that an ASP crash won't take the Web server down as well.

Microsoft designed ASP to be language-independent, meaning that you can choose the language you want to use to write your server-side scripts. In practice, two scripting languages are available: a stripped-down version of Microsoft's Visual Basic, called VBScript; and JScript, Microsoft's version of Netscape's popular JavaScript language.

ASP, OBJECTIVELY

The five built-in objects that come with ASP are the key to simplifying Web applications development. You can use these objects to

Scripting Techniques

There are many ways to write server-based Web applications. Template-based scripting engines such as Microsoft Active Server Pages (ASP) are more powerful than plain CGI, but they lack the sophistication of full application servers in both development and deployment.

Technology	Sample products	Overview	Fault tolerance and scalability	Best fit
Simple scripting	CGI	Traditional CGI scripts lack built-in transaction and object orientation	None	Simple Web sites
Template-based scripting	Allaire's Cold Fusion, Microsoft Active Server Pages, Netscape's server-side JavaScript	HTML template files combined with application code written in a scripting language. This method provides transaction capabilities and simple object orientation.	None	Workgroup applications
Application servers	NetDynamics and Netscape Application Server (Kiva)	Dedicated servers that handle application logic, usually written in C++ or Java. They provide sophisticated transaction capabilities and complex object models.	Built-in fault tolerance and load-balancing capabilities	High performance applications with complex business logic

store application variables, retrieve browser request information, and create instances of ActiveX objects. The five objects, described below, are Session, Application, Request, Response, and Server.

Session. The Session object is used primarily to store variables associated with a given user session within the application. For example, if you have a user specify a language preference in a "language" field inside an HTML form, you can store that field as a user_lang variable within a Ses-

session object variable is in play for all the application's users. By contrast, variables in Session objects are unique for each user who accesses the application.

Unlike Session objects, Application objects remain active for the life of the application. An Application object is first created once a user accesses a page within the application and doesn't go away until the application is unloaded or until the Web server stops.

Request. The Request object is

```
<% LANGUAGE="VBSCRIPT" %>

<HTML>
<HEAD>
<META NAME="GENERATOR" Content="Microsoft Visual
InterDev 1.0">
<META HTTP-EQUIV="Content-Type" content="text/html;
charset=iso-8859-1">
<TITLE>My first ASP Page</TITLE>
</HEAD>
<BODY>

<p>The time is now <%Response.Write Now%>

</BODY>
</HTML>
```

FIGURE 1: ASP commands are embedded in HTML code, are executed on the server side rather than being sent to the requesting browser for execution.

sion object as follows: `<%Session("user_lang")=Request.Form("language")%>`

In subsequent pages within the application, you can check the user_lang Session variable to determine the language in which to output your data for that specific user session.

Session objects don't last forever. Specifically, if a user does not access any Web pages for 20 minutes, then that user's session object goes away.

Since multiple users access a single instance of an Application object, you must pay attention to concurrency issues. ASP provides a Lock method to ensure that no two threads try to modify an Application variable at the same time.

Application. The Application object is similar to the Session object, except that a single instance

used to access information associated with an HTTP request. This information can consist of user-input fields coming from HTML forms, cookies, x.509 certificate fields, or standard CGI environ-

```
<HTML>
<HEAD>
<META NAME="GENERATOR" Content="Microsoft Visual
InterDev 1.0">
<META HTTP-EQUIV="Content-Type" content="text/html;
charset=iso-8859-1">
<TITLE>My first ASP Page</TITLE>
</HEAD>
<BODY>

<p>The time is now 5/4/98 8:19:08 PM

</BODY>
</HTML>
```

FIGURE 2: When the HTML source code is downloaded to the client's browser, ASP commands are implemented as ISAPI applications.



ment variables (or "server variables") that come with standard HTTP requests.

For example, the following line of code prints the IP address of the requesting machine: `<%Request.ServerVariables("REMOTE_ADDR")%>`

Response. The Response object is usually used for two reasons: to output data (including cookie values) to the requesting client and to set the cache-timeout value for the HTML document within the client browser. In our first code segment, for instance, we used the Response.Write method to output current date and time to the requesting client.

The Response.Expires property records the time in minutes in which the client uses a cached version of the resulting HTML page it receives before requesting a new version of the Web page. By setting this property to 0, you can force the browser to request a fresh copy of the page every time the user requests it. In this way, you can be sure that users always view the latest version of the requested page.

Server. The most important

function of the Server object is to create instances of ActiveX components. You use the Server.CreateObject method, as follows, to instantiate an ActiveX component: `Set myDBConnection=Server.CreateObject("ADODB.Connection")`

ACTIVE X COMPONENTS

ActiveX components are the key to making your Web applications truly useful. IIS 4.0 and Visual

You can force the browser to request a fresh copy of the page every time the user requests it.

InterDev bundle a number of ActiveX components that you can access from within scripts to extend the functionality of your Web applications.

Probably the two most often used ActiveX components are Database Access and TextStream. Database Access uses ActiveX Data Objects (ADOs) to access data in

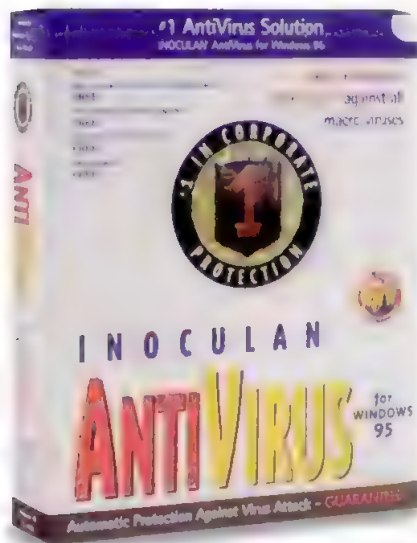
ODBC-compliant databases such as Microsoft Access or SQL Server. The TextStream component is used to retrieve and modify data in text files on the server's file system.

There are several other useful prebuilt components that developers may find useful. IIS 4.0 comes with collaboration data objects you can use to send mail to and gain information from MS Exchange Server. Visual InterDev provides a Browser Capabilities component, which maps Web browser types with a list of browser capabilities (such as frames, Java, or JavaScript support). And the Advertisement Rotator provides a simple mechanism for rotating the ubiquitous banner ads within a Web site.

You are not restricted to the ActiveX components provided by Visual InterDev. You can create your own custom ActiveX components using development tools such as Visual Basic. By adding custom components along InterDev's bundled components, you can quickly create powerful applications with a modest investment of time and effort. **PC**

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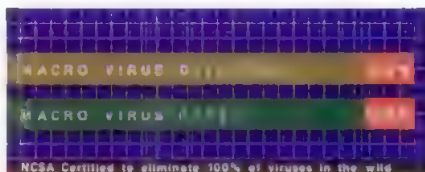


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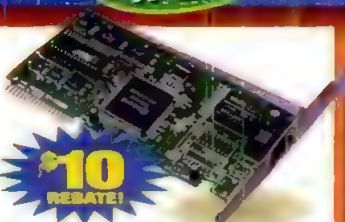


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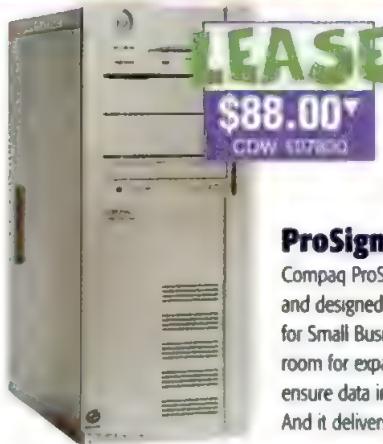
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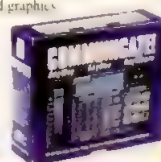
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PC Tech



Graphing Libraries

We take a look at five packages that help you add professional-quality data graphing to your applications.

By Steven E. Sipe

As the old saying goes, a picture is worth a thousand words. That certainly applies when it comes to displaying data in your application. In the text-based DOS days, spreadsheets and databases provided simple ways for users to collect and organize their data. Although the early applications provided many capabilities for entering and manipulating data, they generally fell short in the area of data presentation, with reporting utilities that provided only a simple means of producing text output.

Today, users of Windows applications expect to be able to create graphical representations of their data. The current generation of Windows-based spreadsheets (such as Microsoft Excel) allows you to create reports that present data using many different styles of graphs. These new

graphical data views make it much easier to understand what you're seeing. Suppose, for example, you want to display sales totals for each of your company's ten divisions. If you display the totals in the form of a pie graph, where each pie segment represents a corporate division, you can easily see how a particular division stacks up by comparing the size of its pie slice. You can spot the divisions with the highest or lowest sales totals just by locating the largest or smallest pie slices, respectively.

As a developer, you might want to add graphical data presentation to your products to make them more intuitive or more competitive with another company's offerings. As is typical with many Windows development tasks, you have several options for adding these capabilities to your applications. Each option has its own merits,

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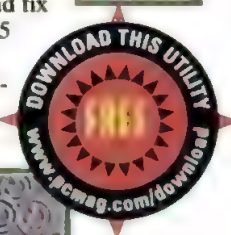
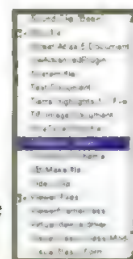
INSIDE

TUTOR: Our exploration of PC microprocessors continues with a look at instruction sets, language levels, superscalar designs, the RISC-versus-CISC controversy, and the evolution of the Intel 8086 family of chips. *Page 263.*

OPERATING SYSTEMS: The Windows Scripting Host, Microsoft's recently released tool, offers file- and folder-handling facilities that let scripting languages like VBScript and JScript accomplish tasks like deleting all files with a specific extension. *Page 267.*

UTILITIES:

Freedom of Association is now more than a right guaranteed by the Constitution; it's our latest free utility, which lets you find and fix Windows 95 file association problems. *Page 271.*



PC SOLUTIONS: Launching more than one program with a single shortcut; advice on upgrading notebook PCs; centering images in your Microsoft Word 97 documents; two recalculation bugs in Microsoft Excel 97; changing the default selection in Microsoft Access's Edit Find dialog. *Page 275.*

and you determine the approach that works best for you purely by the level of sophistication that your application requires.

One approach is to write your own graphing code using the line and shape drawing primitives provided by the Windows Graphical Device Interface (GDI). These routines let you create graphical objects such as rectangles, lines, and circles. They work pretty well for creating the simplest line or bar graphs, but using them requires a detailed knowledge of Windows graphics programming. The routines may require you to write some external code in C, if you're using a programming language other than C or C++.

A second approach might be to use OLE embedded graphs generated by another program, such as Excel. Embedded graphs are often simple to create and they appear to a user as a part of your application. For example, Microsoft Word provides graphs in its documents by embedding the Microsoft Chart control. To the end user, the resulting graphs appear as an indivisible part of the Word document. The disadvantages of using embedded graphs are that the code to embed a graph can be difficult to write and in many cases users must purchase additional software to create the graphs your program displays.

Graphing libraries are probably the most appealing approach. They allow you to create many different styles of graphs in a similar fashion to using the Windows GDI, but much simpler. Graphing libraries actually use the Windows GDI. They contain the thousands of lines of necessary GDI code to create your graphs, freeing you from the time-consuming task of developing and debugging your own GDI-based code. You can also incorporate these libraries into almost any application that supports calling a DLL or an OCX control. Moreover, you can distribute the graphing library's runtime component royalty-free with your application, unlike OLE tools.

For all but the simplest applications, graphing libraries provide the most attractive solution. They simplify many of the complex aspects of Windows GDI programming, they provide graphing capabilities without requiring additional third-party applications, and they are packaged so that you can use them with any programming language that can call a DLL or an OCX control.

In this roundup we take a look at five libraries that allow you to add sophisticated graphing capabilities to your applications. Several also provide 3-D graphs, allowing you to

configure such attributes as depth and rotation. Each provides its own API (application programming interface) to create and manipulate graphs. While you must still learn the details of calling the APIs, that's a far less daunting task than writing and debugging thousands of lines of Windows GDI code.

Software FX Inc.

Chart FX

Chart FX 3.0 is an excellent tool for adding data graphing capabilities to your application. It has excellent drawing performance and provides support for creating 2-D and 3-D styles of graphs with a professional appearance (Figure 1). Using the package's 3-D options, you can create graphs that are even more eye-catching and appealing than their 2-D counterparts. Chart FX also

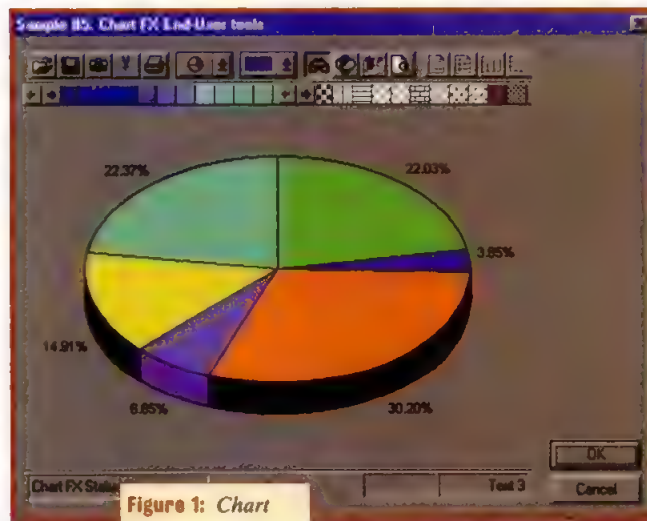


Figure 1: Chart FX produces high-quality graphs, and its color and pattern palettes allow a high level of end user customization.

supports real-time updating for most of its graph styles, allowing you to update a graph's data points and immediately view the results. Furthermore, the drawing code is optimized to repaint only the areas of the graph that need it, so you won't see flicker each time the data changes.

Chart FX also supplies several routines to allow end user customization, most notably a palette control that lets a user drag a new color to a particular graph item and immediately see the color change. In addition to customization of colors, the palette control also lets users choose patterns for shading each graph item. An end user could, for example, change a red solid bar in a bar graph to a cross-hatched green bar.

The Chart FX Programmer's Guide won't

win any awards for extensive coverage of details, yet it still manages to do a pretty good job of covering the basics of the library's functions and OCX properties. But the descriptions of each function call have no accompanying example code fragments, a big weakness. There are a few sample programs that show how to use various functions, but unfortunately, not many—only two for each supported tool. The samples demonstrate some of Chart FX's basic features, but the code isn't commented very well, so you have to search through it to find areas of interest.

The Chart FX graphing library is distributed in separate 16- and 32-bit versions that contain either 16- or 32-bit DLLs, OCXs, Delphi VCLs, and (in the 16-bit version) a VBX. There's also a new 32-bit Chart FX Internet Edition (which was not available for review), which includes a 32-bit ActiveX control. If

you're familiar with OCX/ActiveX terminology, you might be confused by Chart FX's distinction between OCX and ActiveX, since the terms are often used interchangeably. In the Internet Edition, ActiveX refers to a special version of the Chart FX OCX control that was built using Microsoft's Active Template Library (ATL) rather than with the Microsoft Foundation Class library (MFC). Controls produced with ATL are smaller and have better performance than controls built with the bulkier MFC. The controls' smaller size makes them ideal for downloading with Web pages.

Chart FX is a solid package that handles everything from basic 2-D graphs to advanced 3-D graphs. Its real-time graphing capabilities are a major benefit. The graphs have a professional appearance, and the drawing was flicker-free even in real-time updates. Chart FX is also very strong in end user customization. If you're looking for a moderately priced package that does a good job of covering the basics as well as providing some advanced capabilities, you can't go wrong with Chart FX.

Chart FX 3.0. List price: \$249. Software FX Inc., Boca Raton, FL; 800-392-4278; www.softwarefx.com. Choose 561 at www.pcmag.com/infolink.

Sub Systems Inc.

ChartPro

ChartPro 2.0 from Sub Systems supports only five basic graph types: bar, pie, line, high/low and point graphs. And although we found its drawing performance to be quite good, the

graphs didn't have the same level of quality and professionalism as those produced by other packages in this roundup (Figure 2). ChartPro is available in 16-bit and 32-bit versions. Both contain a set of DLLs and libraries you can use with Borland's or Microsoft's C implementations or with Visual Basic.

To begin working with ChartPro, you must first copy its library headers and DLLs to your hard disk. Surprisingly, ChartPro doesn't supply an installation program, so you'll have to do the job manually. No big deal, but the lack of an installer does illustrate the no-frills nature of the package, and considering the fact that ChartPro has the highest list price of any package in this roundup, its do-it-yourself feel is rather disconcerting.

The library files consist of a header file and separate DLLs and import libraries for each of ChartPro's five supported graph types. The use of multiple DLLs can make distribution of your application a little more burdensome, but ChartPro's approach has the advantage of letting you produce smaller applications, since you can include support only for the graph types your application uses. ChartPro also includes the complete source code for each of the package's graphing routines.

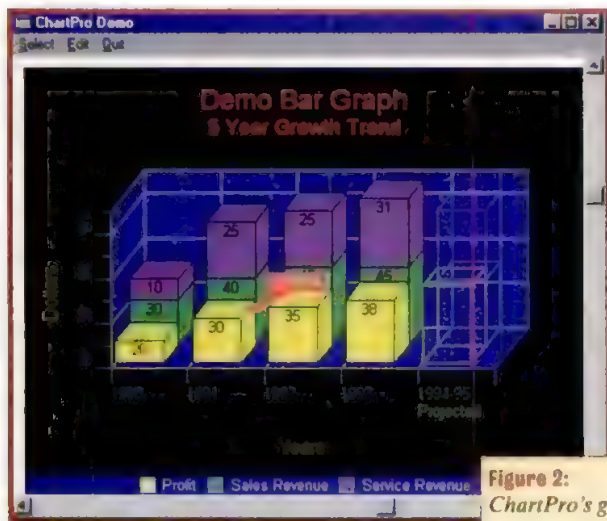


Figure 2: ChartPro's graphs have some 3-D aspects, but their appearance is less polished than the graphs produced by other packages in this roundup.

You begin creating a graph with ChartPro by first calling the `Init` routine for a particular graph type. Next, you define the new graph's characteristics using its associated structures, after which a call to the graph's specific `Show` routine causes it to be displayed on the screen. For example, the process of creating a bar graph involves calling `InitBar` to initialize a set of bar graph (`StrBar`) structures. Next, you can define such characteristics as the number of bars, data points, and so forth by filling in sets of `StrBar` structures and passing them to `InitBar`. The

Editors' Choice

• Graphics Server



Where most of the packages in this roundup allow you

to create professional-quality graphs with advanced capabilities, Pinnacle Publishing's Graphics Server 5.0 provides the most features and most sophisticated capabilities. This is a solid, proven package that has made its way into many commercial applications over the years. With its superior documenta-

tion and fine performance, Graphics Server is a hard package to beat.

The one area in which Graphics Server needs some improvement is real-time graphing support. If that's what you need, you should take a look at Software FX's Chart FX. For its real-time graphing support combined with the high quality of its 2-D and 3-D graph presentation Chart FX merits an honorable mention. Its user guide is well written and provides adequate sample programs. And if price is a concern, you'll be pleased with its \$249 list price, the lowest of any product in this roundup.

final step is to call `ShowBar` to display the new bar graph.

ChartPro, like Software FX's Chart FX, provides support for end-user customization of graphs by providing a specific `Edit` routine for each type of graph. For example, you can call `EditBar` to display a dialog box that allows a user to change a bar graph's colors or fonts. The customization dialog works pretty well, but it's not as elegant as the palette approach taken by Chart FX.

The ChartPro User Manual is a fairly thick, 8 1/2-by-11-inch bound notebook containing prototypes and brief descriptions for each function. There's also a description of each file on the ChartPro library and source code disks and sample code fragments that demonstrate how to create simple graphs. While the code fragments are helpful, you can't count on much help from the ChartPro sample programs. There's only one sample C program (`Demo.c`) included with the distribution and it demonstrates only simple graphs. If you're a Visual Basic developer, you'll be

fancier shading and 3-D support of other packages, ChartPro might work for you. The DLLs are small and easy to distribute, since they don't rely on any external DLLs (such as MFC), and the included source code is a plus if you need to see what the code is doing under the hood. But if you're using tools other than C, or if you need more extensive graphing capabilities along with more professional-looking graphs, you'll probably do better taking a look at some of the other packages in this roundup.

ChartPro 2.0. List price: \$399. Sub Systems Inc., Georgetown, MA; 978-352-9020; www.subsystems.com. Choose 562 at www.pcmag.com/infolink.

Pinnacle Publishing Inc.

Graphics Server



One of the first graphing packages available for Windows, Graphics Server has a large base of commercial products that make use of its capabilities. The latest version from Pinnacle Publishing, Graphics Server 5.0, demonstrates the stability and quality you would expect from a mature product and receives our Editors' Choice designation. Graphics Server provides more than 20 styles of 2-D and 3-D graphs, and the presentation quality is excellent (Figure 3), as is the drawing performance.

The Graphics Server library is distributed in the form of a graphing control (a 16- or 32-bit OCX), a 16-bit VBX, and 16- or 32-bit DLLs. The distribution includes both 16- and 32-bit versions of the library, so you don't need to purchase a separate version if you're still developing applications for 16-bit Win-

disappointed by the lack of VB header files and sample programs in the 32-bit version of ChartPro.

In short, if you're a C programmer looking for high-performance graphing and you're willing to live without some of the

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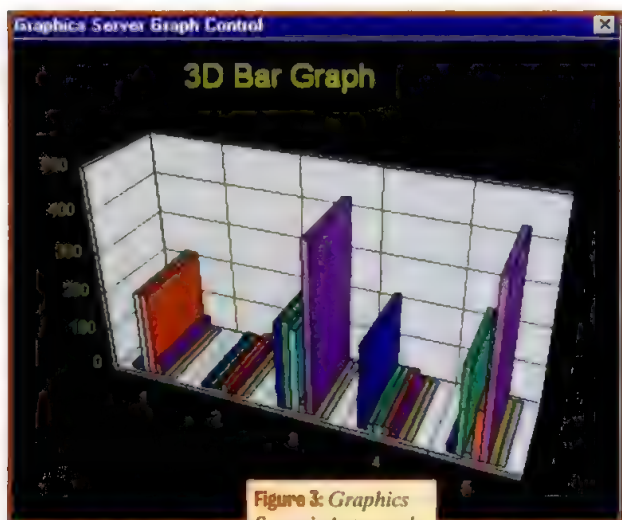


Figure 3: Graphics Server's Autograph routines produce clean, easy-to-read graphs with minimal effort.

dows platforms.

Creating a graph with Graphics Server's graph control is quick and painless. Simply drag the control from your resource editor's tool palette and place it in the desired location on your form. Then you can change the graph's visual characteristics by using the graphing control's property sheet, where you'll find many of the nearly 100 properties the control supports. Most of the control's properties can be changed at design time, but a few can be changed only when called at runtime.

With the DLL version of Graphics Server, you have two different approaches for creating graphs. The quickest is to create an Autograph, a style of graph designed to handle automatically the placement of graph components such as legends, titles, and so forth. You can configure many of the Autograph's characteristics, such as its colors or fonts, by calling one of the many Autograph routines. For instance, you can call `AGTitle` to set the title. Once you've defined each of the Autograph's characteristics, a call to `AGShow` will display your new graph on the screen.

For the brave of heart, Graphics Server also provides a large set of low-level routines that let you build a graph one piece at a time. For example, there are routines to draw bar graph bars, legends, cages (the grid behind the graph), and so forth. The low-level routines are straightforward to use but can be tedious in requiring you to determine the precise location of each part of your graph. Creating graphs in this piecemeal fashion requires more development time than creating an Autograph.

Graphics Server's documentation is also above average. It consists of several well-written, well-organized manuals that furnish enough information and examples to be helpful but not overwhelming. Sample programs for each type of supported development tool demonstrate the basic steps necessary for creating a graph. The sample code is well written but not well commented. Still, the quality of the documentation and of the product itself offsets this limitation.

Graphics Server 5.0. List price: \$349. Pinnacle Publishing Inc., Seattle; 800-231-1293; www.graphicsserver.com. Choose 563 at www.pcmag.com/infolink.

KL Group

Olectra Chart

Olectra Chart 5.0.1 provides support for creating a large number of different graph styles, and the graphs it produces are of high quality and look professional (Figure 4). The product offers the standard fare of 2-D style graphs (such as pie, bar and line) along with the more

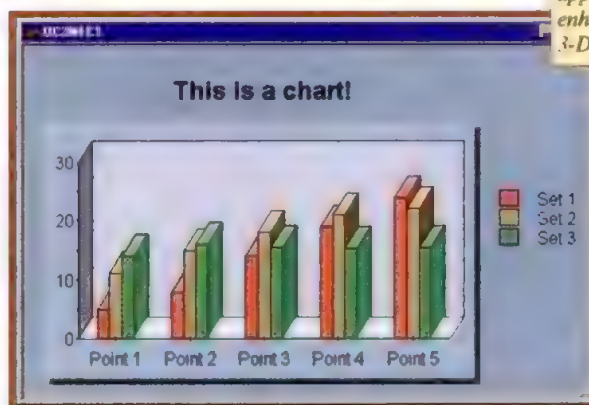
teristics of your new graph. Olectra Chart's graph control lets you change many aspects of a graph, including the color of each graph item, the fonts for text display, and so forth. If you're creating a 3-D graph using the 3-D graph control, you can also configure such properties as the graph's angle of rotation and depth.

As you might expect, creating a graph programmatically with the Olectra Chart DLL is a little more complicated than creating one visually with the OCX control. The first step is to create the new graph window by calling `XrtCreateWindow` with several parameters, such as the graph's size, location, and parent window handle. The next step is to configure the graph's visual characteristics, which you configure by calling `XrtSetValues` and specifying the property that you would like to change. For instance, you can call `XrtSetValues` along with the `XRT_HEADER_FONT` property to change the font used in the graph's header text. When you've finished with the new graph, you can destroy it by calling `XrtDestroy`.

Olectra Chart's documentation is well written and provides an acceptable level of information for each of the functions and properties. There are separate manuals (four in all) for each of the 2-D and 3-D versions of the

DLLs and OCXs. Olectra Chart offers plenty in the way of documentation as well as a number of sample programs ranging from simple to complex. The

Figure 4: Olectra Chart's graphs have a professional appearance further enhanced by their 3-D perspective.



samples contain virtually no comments—rather irritating, considering the main point of a sample program is to teach by example.

Olectra Chart is a solid package that provides very good support for creating professional-looking 2-D and 3-D graphs along with documentation that guides you through the basic steps. It is an effective tool for adding graphing capabilities to your applications.

Olectra Chart 5.0.1. List price: \$349. KL Group, Toronto, Ontario, Canada; 800-709-2947; www.klg.com. Choose 564 at www.pcmag.com/infolink.

GigaSoft Inc.

ProEssentials 2.0

ProEssentials 2.0 lets you create several styles of 2-D graphs. The current version doesn't support 3-D graph styles, but GigaSoft says a new version adding 3-D support should be available by the time you read this. We found the appearance of the 2-D graphs to be fairly good (Figure 5) but not on a par with some of

advanced 3-D styles, such as contours. The library is distributed as 16- and 32-bit DLLs and OCXs. KL Group chose to separate the product's 2-D and 3-D functionality, so you'll find separate sets of DLLs and OCXs in the distribution files for 2-D and 3-D graph styles.

To begin working with the Olectra Chart OCX, you decide whether to create a 2-D or 3-D graph. Once you've decided, adding graphing support is a simple matter of dragging the Olectra Chart control from your resource editor's tool palette to a form in your application. Then you can open the control's property sheet to configure the visual charac-



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the other packages in this roundup. The library consists of 16- and 32-bit OCXs, DLLs, and Delphi VCLs, plus a 16-bit VBX. Both 16-bit and 32-bit versions are included in the distribution, so you don't need to purchase separate packages for dual-platform support.

The steps involved in creating a graph with the ProEssentials OCX control are much the same as we've seen with the other OCX graph controls in this roundup. Just drag the control to a form and set its properties using its property sheet. ProEssentials' graph control supports many of the same properties we've seen with other controls (such as colors and fonts). It also lets you configure some low-level non-visual properties. For example, one property sets the control's debug mode. When debug

ProEssentials also has support for real-time data graphing, although its real-time support isn't as extensive as that provided by Chart FX. You can append data to an existing data set and to control how the new data is to be treated. For instance, you can specify whether your new data becomes the new ending data point, effectively scrolling the rest of the data points to the left, or whether the total number of data points should increase. The drawing of our real-time graphs was flicker-free and exhibited good performance.

The ProEssentials User's Guide is thorough and well written, but it is heavy on the reference side and light on the overview-and-examples side. The first few chapters describe the programming interfaces for the various DLL, OCX, VCL, and VBX components, and there are sample code fragments intermixed with the descriptions of each component interface. The problem is that these first few chapters comprise only about a quarter of the manual. The remainder consists of appendices covering specific details of the DLL interface and

OCX properties. Unfortunately, you won't find much sample code in these hundreds of pages.

ProEssentials does include some sample programs that show how to use the various functions, but there aren't enough of them—only one for each supported tool. Each sample covers the basics well but demonstrates only a few of the many available function calls.

ProEssentials performed well. The quality of the graphs wasn't quite as good as other packages in this roundup, but it is still more than good enough for most uses. Both DLL and OCX performed well, and the large number of configurable properties allow a high level of flexibility in creating sophisticated graphs. With the addition of 3-D graph support, ProEssentials could very well make the transition from an average graphing package to a superior tool.

ProEssentials 2.0. List price: \$349. GigaSoft Inc., Keller, TX; 817-431-8470; www.gigasoft.com. Choose 565 at www.pcmag.com/infolink. **PC**

Steven E. Sipe is a developer based in Wilmington, North Carolina, and a frequent contributor to PC Magazine.

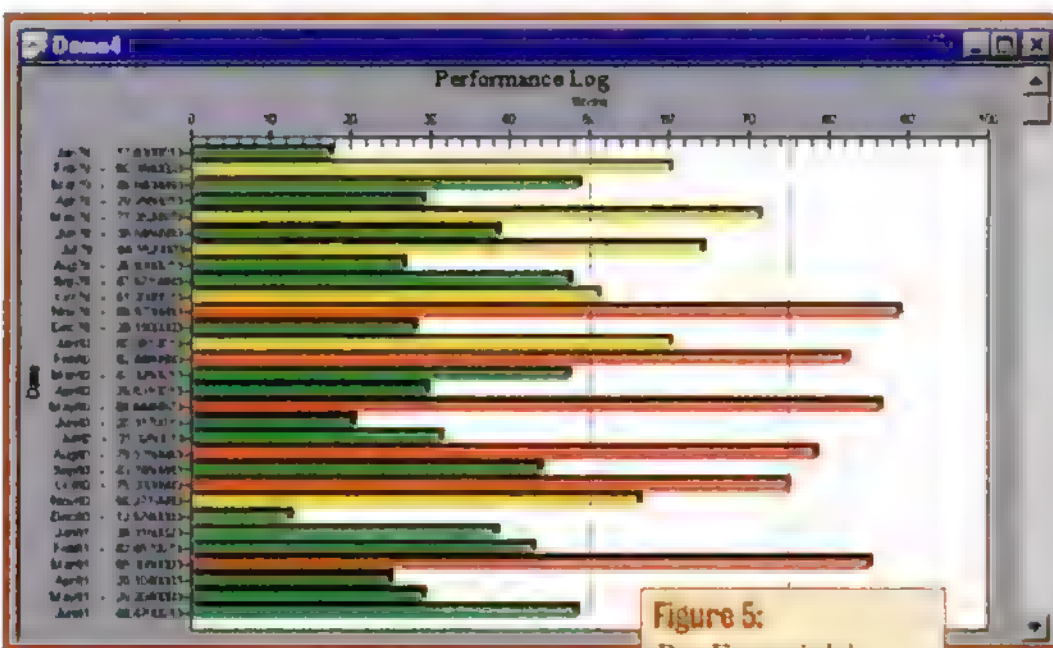


Figure 5:
ProEssentials' graphs look appealing but could benefit from some 3-D enhancements.

mode is enabled, any graph control warnings (such as invalid parameters) are displayed in your debugger's console window. GigaSoft recommends that you run the control in this mode at least once before your product is released, so that you can verify that your graph creation code is error free.

ProEssentials' DLL programming interface also contains many routines for configuring and displaying a graph. We found the process of creating a graph using the DLL routines to be simple and straightforward. You start by calling the `PEcreate` routine to initialize a new graph window. To configure the various visual characteristics of a graph you must call routines such as `PEset` and `PEvset`, which let you set properties consisting of integer values or void data pointers. Once you've finished configuring the properties, a call to `PEreinitialize` and `PEreset` image forces the graph to display itself. This final step seemed a little odd at first. One might reasonably expect some type of `Show` call to display a newly created graph—as we've seen with other packages—rather than a call to reinitialize and repaint. Although this approach feels a little awkward, it seems to work fine, and ProEssentials' documentation points out in several places the need for making these two calls.



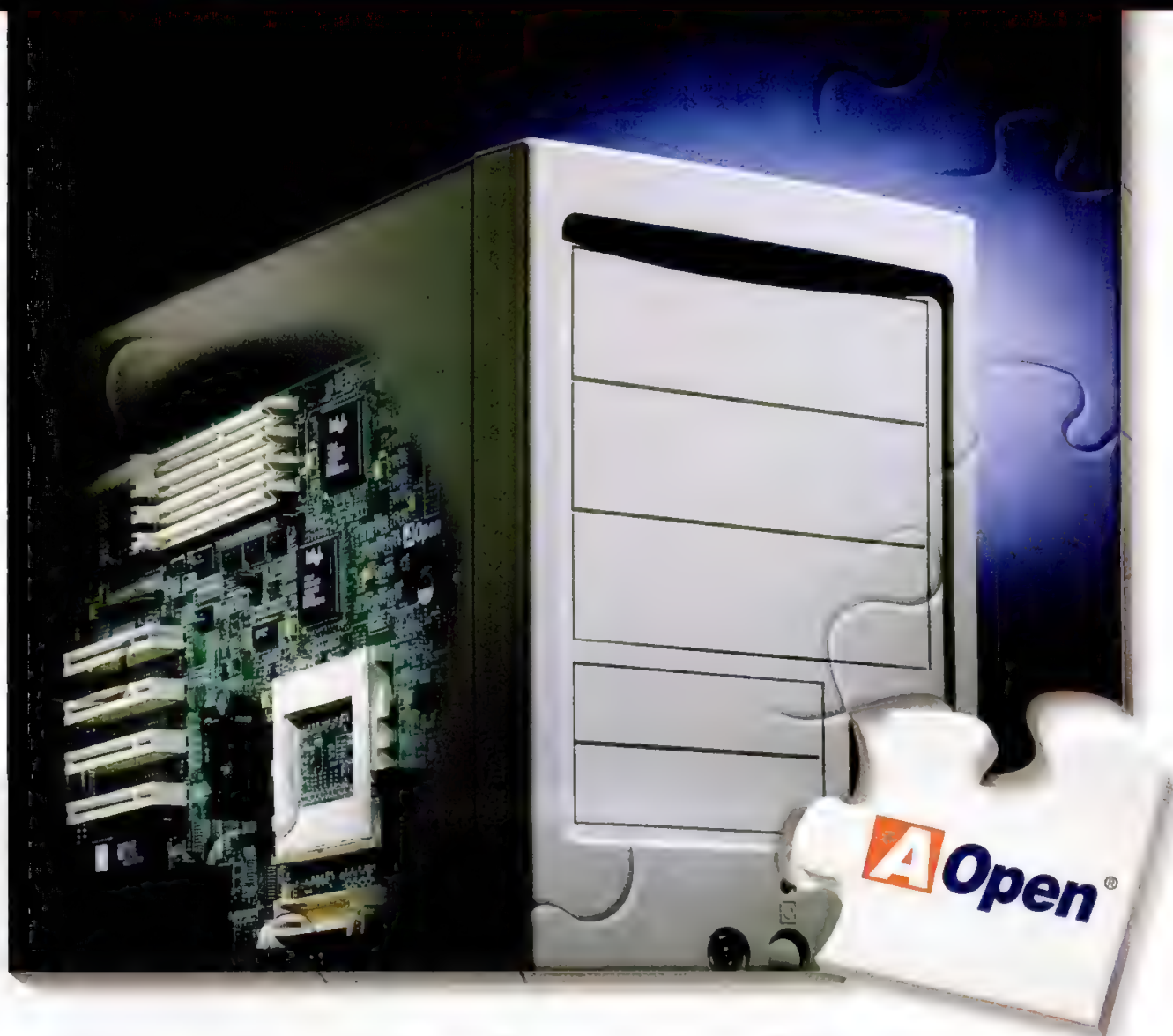
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What Makes Your Processor Think?

Our examination of processors continues as we explain instruction sets and how they make your processor work.

By Neil Randall

Now that you know what your microprocessor is made of (if you missed it, see the June 9, 1998, Tutor column), it's time to delve into the intricacies of how a processor works. We'll begin by examining the important role of the instruction set and finish with a look at the evolution of the Intel processor family. And along the way, I'll briefly explain other terms that I think you'll find worth learning.

INSTRUCTIONS

Computers run on low-level commands called *instructions*. By *low-level*, we mean that these commands work directly with the processor, in effect communicating with the processor's most basic capabilities. Each type of processor has a specific group of these commands on which it can act; this group is called the processor's *instruction set*.

The processor's instructions are accessible to human programmers through various programming languages. The instructions themselves are written in machine language, the lowest-level language of all, which consists solely of numbers and thus is rarely used by programmers. To get around this difficulty, programmers turn either to assembly language, which uses the same instructions but gives them names (such as *add*), or to a high-level language (HLL), in which the machine instructions are encompassed within larger-scale commands. Figure 1 illustrates these language levels.

HLLs don't dispense with machine instructions in any way; they simply make them easier to work with. A program written in an HLL must be compiled, usually first into an internal intermediate language, then to machine language. The two stages, called a compiler front end and back end, allow the compiler writer to separate the parts of the process that are architecture-neutral from those that are architecture-specific. Ultimately, the processor must receive numerical instructions to do anything at all.

Typical instructions for the x86 instruction set, which has formed the basis of the PC environment for years, include commands

for such activities as arithmetic functions, data movement, logical instructions, and input/output instructions. Arithmetic instructions include *add*, which adds the contents of different registers together, and *inc* (increment), which adds 1 to the value in the register. Data movement instructions include *mov*, which moves data from one register or memory address to another register or memory address, and *xchg* (exchange), which swaps the values in two different registers or mem-

ory addresses. All programs consist of combinations of the wide variety of instructions available to the processor.

SUPERSCALAR DESIGNS

Last time we mentioned *pipelining*, the technique that allows a processor to start the execution of a new instruction before completing the current one. Pipelining saves time by ensuring that the microprocessor doesn't have to wait for instructions; however, processors can still complete just one instruction per clock cycle. To increase efficiency and thereby save processing time, today's processors (Compaq/Digital's Alpha, IBM/Motorola's PowerPC, Intel's Pentium line, and Sun's SPARC) feature *superscalar* architecture. The main benefit of superscalar technology is that it allows processors to execute more than one instruction per clock cycle with multiple pipelines.

In a superscalar design, the processor looks for instructions that can be handled within the same clock cycle and processes these together. In the Pentium processor, for example, simple instructions such as *mov*, *or*, and *add* can be processed in this way, although only under specific circumstances (one instruction cannot require the results of a second). But more complex instructions such as those involving floating-point operations can't be handled this way at all.

Parallel processing offers obvious speed benefits, but superscalar technology has critics. Some argue that it wastes many opportunities for parallel execution, because combining individual instructions takes too much time and because individual instructions are often delayed while waiting for resources. For example, say instruction A is being executed from one pipeline and instruction B from another. Instruction C waits in the first pipeline for instruction A to finish. When instruction A finishes, the obvious thing to do is to replace it with instruction C, the next one in that pipeline. But if instruction C needs the results of instruction B, currently being executed from the other pipeline, it has to sit and wait. This defeats the attempt at parallel execution and ruins any chance of increased speed. Your expensive new processor is basically twiddling its thumbs.

Even in a well-designed program—one that attempts to make full use of both pipelining and parallel execution—pipelines can get clogged. To help combat this gridlock, engineers have designed superscalar processors to perform *out-of-order execution*. If a free pipeline has nothing to do because instruction

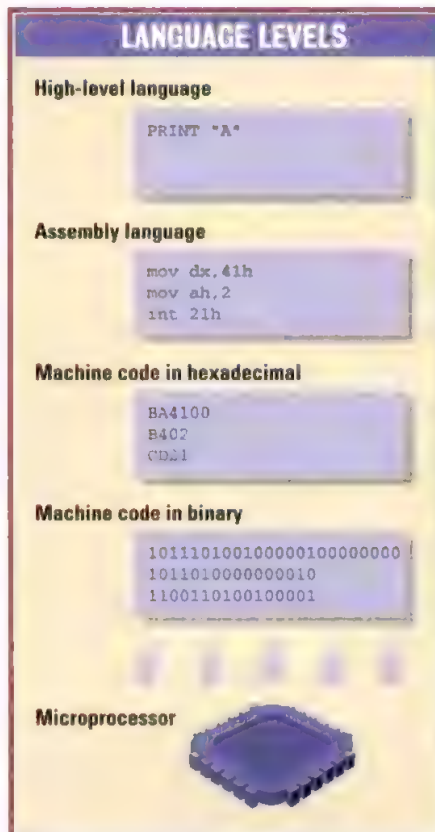


FIGURE 1: The briefest way to output the letter A to the screen in a high-level language like BASIC is shown at the top. The smallest assembly-language version to do the same thing is shown below that, along with its translations into hexadecimal (base 16) and binary (base 2) machine codes. The last format, when translated to high (1) and low (0) voltages, is how the microprocessor actually sees the instructions.

C needs the results of instruction B, the processor can look for the first instruction in the program that doesn't depend on instruction B (instruction H, let's say). It then starts working on instruction H and related instructions until instruction B is finished, at which point it goes back to instruction C. Instead of sending the results of the out-of-order instruction into the registers (where the processor directly deals with data), the processor sends them to a buffer for storage, then sorts everything into the proper order before releasing them.

One possible problem with out-of-order execution is that two instructions may need to use the same register. To compensate for this, today's processors can change the names of registers on the fly, in a process known as *register renaming*. Clearly, out-of-order execution requires extremely careful processor design, because programs will possibly fail if instructions are not processed in the proper order.

INSTRUCTION SETS: RISC AND CISC

An instruction set is the specific group of instructions that a particular processor can recognize and execute. Over the years, a debate has raged over two processor-design philosophies surrounding the implementation of instruction sets. The first approach, initially known as *microcode*, is CISC (*complex instruction-set computing*). On the other end is RISC (*reduced instruction-set computing*). Your Nintendo 64 game machine, PowerPC Macintosh, and Silicon Graphics workstation all use RISC technology, while your Intel PC and your 680x0 Macintosh use CISC designs. The actual difference between the two is lessening all the time, but the debate continues.

The first processors used hardware to execute each instruction. These *hard-wired* processors were extremely fast, since there was no software for the instructions to work through. As you might imagine, though, this approach caused a major problem: Any change to the hardware required a change to the (software) instructions as well, and vice versa. Simple programs were possible, but adding complexity was nearly impossible. To get around this problem, IBM devised *microcode*—simple software stored on the chip from which the processor obtained its instructions.

One advantage of CISC's microcode was that the instruction set could be modified much more easily than before, and thus increasingly complex instructions were possible. Also, because each instruction replaced several simple hard-wired instructions, pro-

grams could be written with a smaller number of instructions overall. Another advantage was that CISC programs took less memory space, and memory was expensive back in the sixties and seventies. However, handling these complex instructions was substantially more work for the processor. And different complex instructions required different numbers of clock cycles. Thus microcode had disadvantages, too.

The solution to complexity, of course, is simplicity, and that's precisely what the RISC initiative attempted in the mid-1970s. The basis for RISC was that even with microcode designs, the vast majority of a processor's time was spent executing simple instructions, not complex ones; researchers came to realize that a sequence of simple instructions could often outperform a single complex instruction. In a RISC design, there are fewer

One advantage of CISC's microcode was that the instruction set could be modified much more easily than before, and thus increasingly complex instructions were possible.

instructions, and each is the same length (32 bits) and can be executed in one clock cycle. Microcode disappears for most frequently executed instructions, with RISC processors returning to the premicrocode system of hardware logic. Replacing microcode is the processor's high-speed memory cache, in which sequences of instructions are stored. In a RISC design, programs must be carefully compiled to optimize use of the processor's instruction set, and pipelining must be used to its greatest effect.

As soon as the RISC design appeared, the microcode design was renamed CISC. The most widespread CISC designs, of course, are the Intel family of processors, IBM mainframe processors, and the Motorola 680x0 processors. The most popular instruction set is the x86 instruction set, initially designed for the Intel 8086 processor and still fundamentally in place in today's Pentiums. The most recent addition to the x86 instruction set has been MMX, a set of 57 new instructions that apply primarily to multimedia

programming. The x86 instruction set may disappear with Intel's upcoming IA-64 instruction-set architecture. The first implementation of the architecture will be the upcoming 64-bit Merced (P7) processor, incorporating an essentially new instruction set for the first time in the PC's history. Intel has publicly proclaimed that x86 instruction-set support will be included in Merced, but it has not yet specified how the compatibility will be achieved.

THE INTEL PROCESSOR FAMILY

Although the term *PC* means *personal computer*, today it's used almost exclusively to mean a machine running an Intel or Intel-compatible processor and a Microsoft operating system (DOS, Windows 95, or Windows NT). This wasn't always the case: Apple II computers used to be called PCs, as did Commodore 64s and any other computer that was smaller than a minicomputer.

But when IBM entered the market back in 1981, it called its machine the IBM-PC, and non-IBM machines capable of running applications written for that machine became known as *IBM-PC-compatibles*. The term was shortened to *IBM-compatible* or *PC-compatible* and soon to just *PC*. It wasn't always necessary to run a Microsoft operating system, since OS/2-powered machines were also called PCs. These machines shared one thing: the Intel processor. Today you can buy PCs with Intel-compatible processors (and we'll look at those next time), but most PCs still sport Intel chips—which is pretty much the way it's been since the early days.

4004 THROUGH 80286

The first Intel design was the 4004, way back in 1971. The 4004 was a 4-bit processor and could do little but basic arithmetic calculations. A year later, Intel upped the ante with an 8-bit version of the 4004, the 8008, and it ran at roughly 0.2 MHz. A couple years after that, the 8080 came along, offering a more powerful instruction set. The 8080 formed the basis of Zilog's (not Intel's) Z80 processor, for which CPM—the first personal-computer operating system—was developed. The first serious processor to come from today's hardware giant was the 8086, released in 1978 with a 16-bit data bus. But the 16-bit bus was too expensive at the time, and very little 16-bit hardware existed, including motherboards. So Intel reengineered it with an 8-bit external design and in 1979 released it as the 8088. The registers were still 16 bits in size (like the 8086's), but the 8-bit data bus brought it back into compatibility with the hardware of the late seventies. The 8088 became the heart of

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the IBM-PC, while the more capable 8086 was relegated to a secondary role in clones. The 8088 was capable of 4.77-MHz and 8-MHz speeds, and the 8086 handled these two speeds and also 10 MHz.

In 1982, Intel released an extremely important processor: the 80286. When this found its way into the spanking-new IBM PC-AT in 1984, we began to see just what PCs might be capable of. It offered a 16-bit data bus, 24-bit addressing, and a 16-bit register size, and its processing efficiency was so advanced over the 8088's that even at its introductory speed of 6 MHz, it performed at well over four times the speed of the 4.77-MHz 8088. The 286, as it came to be known, was soon introduced in speeds of 8 MHz, 10 MHz, and 12 MHz. It was capable of addressing 16MB of memory, which was a real advance over the 8088's 1MB. It also offered full compatibility with its predecessor by including two modes of operation, *real* and *protected* mode, the first emulating the 8088 (with that chip's 1MB restriction) and the second allowing protected memory ranges to be isolated from one another to avoid program conflicts. Unfortunately, DOS didn't handle protected mode well, so that option remained largely unused until DOS extenders and then OS/2 were introduced.

The 286 had a significant drawback that shortened its life, however: 286-based PCs booted into real mode and could be switched via software to protected mode, but there was no way to switch back without rebooting. This, of course, limited the 286's usefulness for backward compatibility with real-mode programs, which constituted the vast majority of commercial and noncommercial programs available at the time.

THE 80386

The 80286 only hinted at what was possible with the x86 instruction set and the established CISC architecture. When the 80386 was introduced in 1985 (in a Compaq rather than an IBM machine), the personal computing phenomenon began to take shape. The 386 was the first 32-bit Intel processor, after all, with a 32-bit data path and register size. It could address up to 4GB (gigabytes) of memory, and its speeds—ranging from 16 MHz to 33 MHz (AMD and Cyrix 386 clones went all the way to 40 MHz)—made it the fastest Intel processor so far. The first chip to hit the market was simply called the 80386, but soon after that Intel released the 80386SX (more on this later). For a further distinction between the two models, the original chip began to be referred to as the 80386DX. The SX and DX distinction carried through to the 80486 fami-

ly, but not into the Pentium family.

Not only could the 386 address much more memory than the 286, it also allowed memory to be addressed as one large chunk. The 286 handled memory in segments of only 64K, despite having a potential full 16MB to work with. The benefit of addressing memory as a single large chunk is that applications and their data can be loaded into all the memory available on the individual machine, and once loaded they can be accessed much more quickly. The 386 also featured a small chunk (16 bytes) of a built-in instruction queue and the ability to load the data that the processor would require next.

While the 286 operated in two possible modes, the 386 introduced a third. Real mode still allowed full compatibility with programs designed for the 8086, and like the 286, the 386 entered real mode at boot time. Protected mode was also still a feature, and it worked like the 286 chip in this mode. The new mode was called virtual 8086, in which the 386 could emulate multiple 8086 chips, each in an isolated memory space. In this way, the 386 became the first practical multitasking chip in the Intel family. The 286 was able to multitask protected-mode programs, but the operating systems and programs of the time offered little support for that feature.

Early 386DX chips were expensive, and they offered few improvements when used with existing DOS-based software. That's why Intel released the 386SX—a different physical design from the 386DX, able to use simpler motherboard circuitry. The 386SX used a 16-bit rather than a 32-bit data bus, although the processor's registers were 32-bit. The 16-bit bus meant a slowdown, since data couldn't be supplied to the processor to keep up with its capacity.

For users, the major advantage of the 80386 family was that its use of memory and multitasking finally made the development of a PC-based graphical user interface (GUI) possible. Microsoft Windows 3.0 ran on a 286, but slowly and inefficiently. Only with the 386 family—with the ability to address a single large memory chunk, the strong use of virtual memory, and the protected and virtual 8086 modes—did Windows begin to acquire the power it needed.

In the next Tutor column, we'll move on to the 486 family and then through the Pentium family. We'll also examine Intel-clone processor families and processors entirely out of the Intel and PC domain. **PC**

Neil Randall is the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage98 (Que)*.

File Management via Windows Scripting

You used to use batch files to automate system chores. Now there's a new way to get things done.

By Gary Cornell

Consider the following common task: You want to delete all the stray temporary (TMP) files on your C: drive. If you're running Windows 95 or NT, you'd probably do it like this:

- Use the *Find* option in Windows Explorer to get a list of all the TMP files, making sure to check off the *Include subfolders* option.
- Press Ctrl-A to select all the files that were found.
- Press Delete.

This isn't hard, but you may hit a snag: The operation halts if Windows encounters a TMP file it can't delete (access is denied if the file is in use).

If you're used to batch files, you may have tried a different technique: First you create a file containing the names of all the TMP files by entering

```
DIR C:\*.TMP /A/B/S > deltmp.bat
```

on the command line. Then, you edit the resulting batch file to put DEL at the start of each line and, finally, run the batch file—a fairly cumbersome solution for a relatively simple task! The upshot is that there is no really convenient way to delete all those TMP files.

Enter the Windows Scripting Host, Microsoft's recently released language-independent scripting host for 32-bit Windows. As we'll see, using the WSH's powerful file- and folder-handling facilities, it is a relatively easy job to write a script that deletes all files with a specific extension. (If you're not yet familiar with the Windows Scripting Host, take a look at "The Windows Scripting Host" in our February 10, 1998, issue.) In this article we'll use VBScript, though the scripting engine supports JScript as well. (One advantage to using VBScript is that you can usually develop your script code in the free Visual Basic Control Creation Edition, which allows you to use all of VB's neat interactive debugging facilities.)

FILE MANAGEMENT OBJECTS

Four file-handling objects are supplied with the scripting engine: a `FileSystemObject` object, a `Folder` object, a `File` object, and a

`Drive` object, which we won't cover in this article. The properties and methods of these objects are exactly what you need to take advantage of the file-handling capabilities in the Windows scripting engine. (For those who have never programmed an object-based language like Visual Basic before, think of *properties* as describing what an object is and *methods* as describing what it can

Using the WSH's powerful file- and folder-handling facilities, it is a relatively easy job to write a script that deletes all files with a specific extension.

do. For example, `Name` is a property of a `File` object, while `Delete` is a method of it.) A table that lists the properties and methods of the three file-handling objects we use in this article, along with brief explanations of them, can be found on PC Magazine Online. If you'd like more details on these properties and methods, you can download the VBScript documentation from www.microsoft.com/scripting.

You always get `Folder` and `File` objects via a `FileSystemObject`, which you get using a call to the `CreateObject` function in VBScript together with the `Set` method:

```
Set FSO = CreateObject("Scripting.FileSystemObject")
```

(We need the `Set` statement instead of a simple "=" since we're setting a variable equal to an object, not to a basic type such as a number.) At this point you can use the `FSO` variable to gain access to the file system on the host computer. The following code, for example,

lets you create a simple text file that contains one line of text:

```
Set FSO = CreateObject("Scripting.FileSystemObject")
Set TestFile = FSO.CreateTextFile("c:\testfile.txt", True)
TestFile.WriteLine("This is a test file with one line in it.")
TestFile.Close
```

For our project we will be working with existing files, which requires using a property of either the `FileSystemObject` or the `Folder` object. The `FileSystemObject`'s `GetFile` method will give you a `File` object associated with the designated file specification (either the filename alone, which will give a file in the current folder, or a full pathname.) The following code lets you get at the various attributes of a file whose file specification is `AFileSpec` in the current folder:

```
Set FSO = CreateObject("Scripting.FileSystemObject")
Set AFile = FSO.GetFile(AFileSpec)
Message = AFile.Name & " on Drive " & UCase(AFile.Drive) & vbCrLf
Message = Message & "Created " & AFile.DateCreated & vbCrLf
Message = Message & "Last Accessed: " & AFile.DateLastAccessed & vbCrLf
Message = Message & "Last Modified: " & AFile.DateLastModified
MsgBox Message, 0, "File Info"
```

A GENERAL-PURPOSE FILE-DELETION SCRIPT

The idea is simple: Once you have a `FileSystemObject`, you can get at a specific folder by giving the folder specification to the `GetFolder` method. Once you have a folder object, you can get at all the files in the folder via its `Files` property. This returns what VBScript calls a *collection*. And once you have a collection, you can run through the items in it using a construct like this:

```
For Each Item In TheCollection
    ' do what you want to the item
Next
```

For example, the following code would try to delete all files in a folder whose extensions are stored in a variable named `TheExtension`, by checking that the rightmost three characters match the extension:

```
Set TheFiles = AFolder.Files
For Each AFile In TheFiles
    If UCase(Right(AFile.Name, 3)) =
```



```
TheExtension Then
  AFile.Delete
End If
Next
```

Note that as written, there are two problems with this code that make it less than ideal. The first is that, for example, you can't delete a file that is in use. You therefore need to catch any errors and tell VBScript to disregard them. This is done with the `On Error Resume Next` statement. The next problem is that in Win32, file extensions are no longer restricted to three characters (you can use, for example, .jpeg, .html, and .java), so you'll probably want to allow for longer extensions. If you want to go beyond deleting TMP and BAK files, the easiest solution is to use the `GetExtensionName` method of the `FileSystemObject`. This takes the path of the file that you want to work with and returns the extension. Then, all you have to do is compare the value you obtain from this method call to the extension you want to delete, like so:

```
Dim FSO, WSH, TheExtension, TheCount
Dim TheFolder, Message, YesNo
Set FSO = CreateObject("Scripting.FileSystemObject")
Set WSH = CreateObject("WScript.Shell")
Set TheFolder = FSO.GetFolder("C:\") 'start at the
                                     root of C

TheExtension = InputBox("What extension to delete-
don't use a '.', example: tmp")
TheExtension = UCase(TheExtension)
Message = "Are you sure you want to delete ALL files
in ALL sub-directories with "
Message = Message & "the extension " & vbCrLf
Message = Message & vbCrLf & vbTab & vbTab & vbTab &
TheExtension
YesNo = MsgBox(Message, vbYesNo)
If YesNo = vbYes Then
  Message = "Press Enter or click on OK to start
the process. "
  Message = Message & "Note, this can take some time.
A message "
  Message = Message & "box will appear for one second
after each "
  Message = Message & "100 sub-directories are
processed. "
  Message = Message & "It will vanish after 1 second
automatically"
  MsgBox Message
  WorkWithSubFolders TheFolder, TheExtension
End If
MsgBox "Done! Worked on " & TheCount & " directories.
Click on OK or press Enter to end."
```

```
Sub KillFilesWithExtensionIn
(AFolder, TheExtension)
Dim AFile, TheFiles
On Error Resume Next
Set TheFiles = AFolder.Files
For Each AFile In TheFiles
  If UCase(FSO.GetExtensionName
(AFile.Path)) = TheExtension Then
    AFile.Delete
  End If
Next
End Sub
```

Now comes the tricky part: We want to be able to apply this routine to all the subfolders of a given directory and then continue the process on all subfolders of subfolders, and so on, until we have traversed the whole chain of sub-sub-sub-subfolders of a given folder. Such a routine is called a *recursive* routine. More precisely, a recursive routine is one that calls itself. Here's the basic procedure:

- We kill all of the appropriate files in the folder that is first passed to the routine.
- Next we find all the subfolders of a given

folder using the `SubFolders` property of the `Folder` object. (This gives us a collection of `Folder` objects.)

- Then we kill all of the appropriate files in each subfolder, by calling the previous routine on each subfolder in the collection of `Folders` returned by the `SubFolders` property.

And here's what the code for the recursive routine will look like:

```
Sub WorkWithSubFolders(ByVal
AFolder, ByVal TheExtension)
Dim MoreFolders, TempFolder
KillFilesWithExtensionIn AFolder,
TheExtension
Set MoreFolders =
AFolder.SubFolders
For Each TempFolder In MoreFolders
  WorkWithSubFolders TempFolder,
  TheExtension
Next
End Sub
```

Note the line inside the routine that calls the routine:

```
Sub WorkWithSubFolders(ByVal AFolder, ByVal
TheExtension)
Dim MoreFolders, TempFolder
TheCount = TheCount + 1 'VBScript has no static
variables,
                           'so use a global variable
If TheCount Mod 100 = 0 Then
  Message = "Have worked so far with " & TheCount & "
  folders."
  WSH.Popup Message, 1, "File deletion at work"
  'super message box 1 second delay
End If
KillFilesWithExtensionIn AFolder, TheExtension
Set MoreFolders = AFolder.SubFolders
For Each TempFolder In MoreFolders
  WorkWithSubFolders TempFolder, TheExtension
Next
End Sub

Sub KillFilesWithExtensionIn(AFolder, TheExtension)
Dim AFile, TheFiles
On Error Resume Next
Set TheFiles = AFolder.Files
For Each AFile In TheFiles
  If
  UCase(FSO.GetExtensionName(AFile.Path)) =
  TheExtension Then
    AFile.Delete
  End If
Next
End Sub
```



FIGURE 1: This script lets you designate by extension a set of files to delete.

WorkWithSubFolders TempFolder,
TheExtension

This is the line that makes the routine recursive. VBScript gives the routine the current-folder object TempFolder and starts the process again. It handles all the management that unwinds the chain of calls to the subfolders of subfolders of subfolders, without your needing to worry about the process.

A FEW DETAILS

One potential problem with using the scripting host for time-consuming processes (like our recursive routine) is worth noting: The scripting host has no truly convenient built-in way to build a window on which you can indicate the progress being made. And since it is not uncommon for a hard disk to have more than 2,000 subfolders, the lack of feedback can be disconcerting. VBScript can create message boxes, of course, but message boxes force the user to click on *OK* constantly. We'll use instead a method that is part of the Windows Scripting Host and displays a sort of super-message box. This method allows you to build a message box that vanishes after a specified number of seconds have passed—whether or not the user has clicked on it. We'll pop this message box up after every 100 folders are visited and keep it on the screen for 1 second. We'll also include a little loop that makes sure the user really wants to proceed. Note that we've hard-coded the program to start in the root directory of C:. To use the code on another drive or directory, change the following line:

```
Set TheFolder = FSO.GetFolder("C:\")
```

to reflect your desired starting point. (Of course, you could also add another input routine that allowed users to set the starting folder.)

Figure 1 shows our completed file-deletion script, which you can download from *PC Magazine's* Web site (www.pcmag.com). See the sidebar "How to Get the Files" in this issue's Utilities column for instructions. As you can see, the Windows Scripting Host, together with the script language of your choice, has the potential to automate many mundane tasks on your system. **PC**

Gary Cornell teaches at the University of Connecticut and has written or cowritten more than 20 computer books. His latest book, called Learn VBScript Now, was recently published by Microsoft Press.



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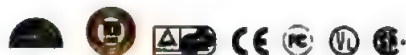
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Freely Manage File Associations

Freedom of Association finds and fixes your Windows 95 file-association problems.

By Neil J. Rubenking

When you launch Readme.txt, Windows obligingly loads the file into Notepad. It knows to do that because the file extension .txt is associated with the file type Text Document, and Notepad is registered as the program that launches files of that type. The Windows 95 Explorer offers just a few functions for managing file associations. Freedom of Association supplies features Explorer lacks and provides an overview of your system's extensions and file types. With this utility, you can:

- review all registered extensions;
- review the file types associated with those extensions;
- clean up invalid entries;
- correct erroneous associations;
- add an extension to an existing file type.

You can obtain Freedom of Association for free by download from PC Magazine Online or by mail. Refer to the sidebar "How to Get the Files" for details. The Delphi source code is provided for those interested in seeing how it works.

EXERCISING FREEDOM

Freedom of Association is supplied as a self-installing application. Run Install to put Freedom into the directory of your choice. The installer will add Freedom, its help file, and an uninstaller to your Start menu. Freedom runs under Windows 95 and Windows NT 4.

To use Freedom, you must have a basic understanding of how Windows file associations work. A file association lets you associate an *extension*, the portion of the filename that follows the rightmost period (for example, TXT), with a *file type*, a collection of properties that contains, at minimum, the open-with

program (for example, Notepad for TXT files). The file type has an *internal name* by which Windows makes the actual association and a *descriptive name* that Windows uses for display. In the system registry, the extension is linked to the internal name and the internal name is linked to the descriptive name. For

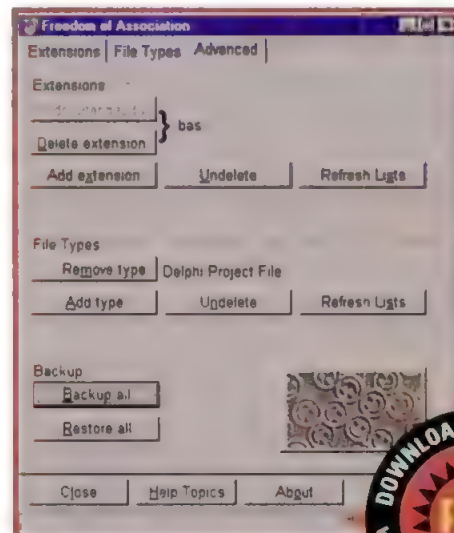


FIGURE 1: Before making any changes to your file associations, you should back up your registry using the Backup button on the Advanced tab.

example, the extension .txt is typically linked to the internal name *txtfile*, and that internal name has the descriptive name *Text Document*.

Freedom's power can be used for good or evil, so the first thing you should do after installing it is to click on the tab labeled *Advanced* and then click the *Backup* button (see Figure 1). This creates a backup of all registered extensions and their file types, so if you make any

mistakes, you can set things right again.

Next you'll want to take a close look at the extensions and file types registered on your system. Chances are very good you'll find some problems. Freedom enables you to fix them while retaining the ability to undo any changes you make.

FINDING PROBLEMS

Freedom's main window has three pages. The first displays registered extensions, the second shows their file types, and the third is for advanced functions. The *Extensions* page (see Figure 2) is active when the program starts. It lists all the extensions registered on your system, with status icons at the left. An extension with a red icon has problems and needs your attention. A yellow icon signifies that the extension is useless but harmless. An extension with a green icon has an item on the *New* context menu, which appears when you right-click on the desktop or on a folder. Since the *New* menu can get crowded, Freedom permits you to suppress a particular item from appearing on it.

The right half of the page displays information about a selected extension, including the name of its associated file type, the program used to open the file type, and the browser-style content type, if any. The status box at the bottom gives detailed information about any problems with this extension. The status box is labeled *Error* in red, *Warning* in yellow, or *Note* in the default text color, and it contains a description of the selected extension's status. In some cases the status box also tells you what actions you may want to take. Click on

Explain or press F1 to bring up further details. If the extension is associated with a valid file type, the *File type* button is enabled. Click it to switch to the *File types* page.

Freedom's *File types* page (see Figure 3) lists every file type associated with at least one extension. The right half of the page displays information about the currently selected file type, including its internal name, the program that opens it, and the icon that represents it. A file type can be associated with

For Programmers Only Freedom of Association is a 32-bit Windows application written in Borland's visual programming tool, Delphi. It compiles under Delphi 3.0 or higher. The source code for Freedom of Association is available from PC Magazine Online (www.pcmag.com) and demonstrates several interesting programming techniques, including how to:

- trace file associations and related information through the registry;
- export registry keys to a REG file in precisely the format used by RegEdit;
- create a suppressible confirmation dialog in Delphi.

Support Help for PC Magazine's free utilities can be obtained in our online discussion areas, both on the World Wide Web (www.pcmag.com/discuss.htm) and on ZDNet in the Utilities section of ZDNet's Tips Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum daily. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who also checks this forum each day, will contact the author for you.

more than one extension, so there's also a list of associated extensions. To view details about a particular extension, select it and press the *To Extension* button.

An otherwise valid file type may be associated with a nonexistent application. Freedom flags such a file type with a red icon. When an extension has all the information that defines a file type but no file type name is registered for it, Freedom (like Explorer) synthesizes a file name of the form *[extension] file*. Freedom displays such a file type with *(synthesized)* in place of its internal name. (You can't associate additional extensions with synthesized file types.) A status box on the right half of the *File types* page provides information and advice about the selected file type. Click on *Explain* or press F1 to bring up further details.

FIXING PROBLEMS

Freedom doesn't just point out problems with your system's file associations. It also helps you solve them. If you make a change that turns out to be a mistake, don't worry. You can change it back.

Extensions with invalid file types (flagged with a red icon) should be repaired or deleted. No descriptive name is available for such extensions, but the internal file-type name may give you a clue as to the corresponding application. If the invalid file type is a remnant of an incomplete uninstallation, you can safely delete the extension by selecting it, clicking the *Advanced* tab, and clicking the *Delete extension* button. If the associated application is present on your system, you should reinstall it, in order to restore the file type.

When an extension or file type is red-flagged because the associated program is missing, the problem may be that you moved the program to a new location. In that case, you can reinstall the program or use *PC Magazine's* utility COA32 to notify the system of the application's new location. If, however, you've removed the application from your system, you should delete the file type. Select it, click the *Advanced* page, and click the *Remove type* button. Freedom backs up the file type's data and then deletes it.

Some extensions are registered with the

system but have no associated file type. In some cases, such an entry serves to define a browser-style content type for the extension. In other cases, a particular application may be storing program-specific information with the extension. If the extension has no associated data at all, however, it's just wasting space in your registry and Freedom flags it with a yellow icon. An extension that has no associated information except a spurious *New* menu item will also be flagged. You can safely delete such extensions.

A green icon indicates a valid extension with a valid file type registered to appear on the *New* menu, which can get quite large. To trim it, select some of the green-flagged extensions and click the button labeled *Disable "New" menu item*. Freedom disables or enables only existing *New* menu items; the utility cannot create a *New* menu item for an extension that doesn't have one.

Now you've corrected the most glaring file association errors. But there can still be subtle problems you'll recognize only as you use your computer. For example, you may find that your bitmap files have somehow become associated with Microsoft Access, or your TXT files with Paint. To correct an erroneous association, highlight the problem extension in the list on the *Extensions* page and click the *File type* button. You'll see the currently associated file type highlighted on the *File types* page. Now highlight the correct file type, switch back to the *Extensions* page, and click the *Associate w/* button. The selected file type appears just to the right of the button. After you confirm the action, Freedom of Association will make the change, recording the previously assigned file type in case you need to undo this action.

There may be cases where you want to remove an extension's association with a file type but leave it registered with the system—if the associated file type is invalid, for example, but the extension has additional registered information. To remove the association, highlight the extension and click *Dissociate*. You can restore the removed association if you need to.

Windows Explorer lets you create a new file type for association with a particular extension, but it doesn't let you associate an extension with an existing file type. Suppose, for example, that you frequently work with plain-text files that have the extension .log. It would be convenient to register these files using the same file type that TXT files use. That way you could take advantage of the print information built into the file type *txtfile*. Freedom makes it easy to do this.

If the extension is already registered, you can use the procedure described above to connect it to a new file type. Otherwise, select the desired file type from the list, then click the *Advanced* tab and then the *Add extension* button. Enter the new extension and click *OK* and the new extension will be associated with the file type.

What if you want to create a completely new file type? Normally file types are added by an application's install program. Explorer provides the tools to create one from scratch, but only a black-belt Windows guru should try it. If you press the *Add type* button on Freedom's *Advanced* page, the utility launches Explorer for you. If you make changes using Explorer, you need to refresh Freedom's lists. To do that, click either of the *Refresh Lists* buttons on the *Advanced* page.

UNDO? NO PROBLEM!

Freedom's mission is to keep your file associations neat and correct. The utility's motto is: "First, do no harm." If you delete an extension or file type, you can restore it. If you change an extension's association, you can put back the original association. And for safety's sake, you can back up and restore all your system's extensions and associated file types. Freedom calls on RegEdit, the system registry editor, to restore deleted extensions or file types. So if RegEdit is not present on your system, the advanced functions that rely on it will be disabled.

Deleted extensions and file types, as well as full backup files, are stored in a subdirectory named Data below Freedom's own directory. These files are stored in the REG file format that RegEdit uses, so if necessary you could restore them by importing them into RegEdit. Full backup files are named using the current date plus a sequential number for backups made on the same day. When you click the *Restore* button, Freedom lists all available backup sets by date, with the newest first, displaying the actual date and sequential number—for example, 04-01-1998 (#01). In most cases, you'll want to restore the most recent one. Once you've made your choice and clicked *OK*, Freedom

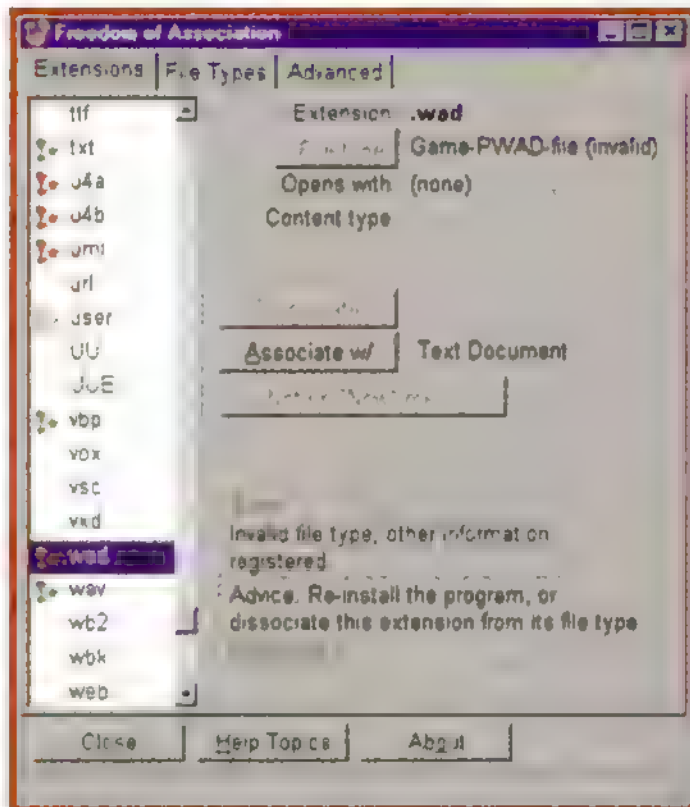


FIGURE 2: Freedom's first page lists all registered extensions and displays details about the selected one.

PCTech Utilities

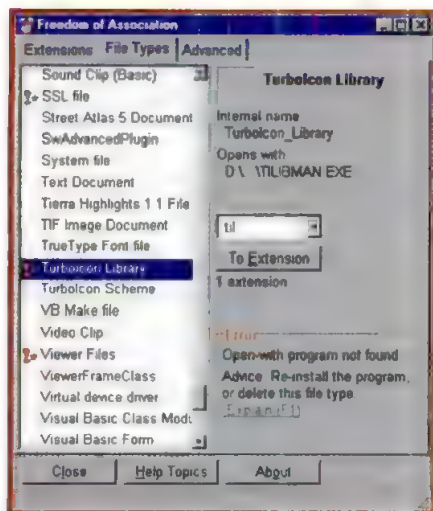


FIGURE 3: The file-types page displays all file types associated with at least one extension and flags problems.

calls on RegEdit to merge the restored data into the registry.

Whenever you delete an extension or file type, Freedom backs up the registration information to a REG file. If you need to restore one of these, click the corresponding *Undelete* button on the *Advanced* page. You'll see a list

of deleted items. Highlight the one you want and press *Restore*. Again, Freedom calls on RegEdit to merge the backup file back into the registry.

After you've restored a deleted extension or file type, you may want to erase the backup file. Backed-up file types are stored using their internal names. If you need to see the descriptive name, highlight the item and press *Name*. Freedom will try to retrieve the descriptive name from the backup file.

Whenever you change the file type associated with an extension, Freedom of Association makes a note of the old file type. If any earlier associations are recorded for a selected extension, the *Undo changes to:* button on the *Advanced* page is enabled. Click it and you'll get a list of all file types that have ever been associated with the extension, with the most recent at the top. To restore the extension's association with one of them, just highlight the file type you want and click *Restore*.

Suppose you've used Freedom to correct an erroneous association. The incorrect file type shows up in the list of earlier associations. You can click *Remove* to get rid of it or *Clear* to clear all earlier associations. This can be handy if you've been experimenting with file types for

a particular extension but are quite sure that you've found the one and only correct one.

After your initial big cleanup, you'll want to run Freedom every few months to catch any new problems. And of course, if you suddenly find that Windows is trying to load DBF files into Sound Recorder, you can run Freedom to fix the problem.

INNER FREEDOM

From a programming perspective, Freedom's most basic task is to read and analyze the registry information that defines extensions, file types, and their relationships. The decision to store backups in precisely the same format RegEdit uses brought another interesting challenge.

READING ASSOCIATIONS

Freedom's lengthy ReadExtInfo method navigates a convoluted path through the registry to record all registered extensions and their associated file types. A registered extension can be defined as a subkey of HKEY_CLASSES_ROOT whose name begins with a period and does not contain any asterisks, question marks, or additional periods. File types are more complicated. They are also subclasses of HKEY_CLASSES_ROOT, and their names do

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not begin with a period. Unfortunately, there's no guarantee every subkey fitting that description is in fact a file type. The only sure way to identify a subkey as a file type is by its association with at least one extension, so only file types referenced by at least one registered extension are included in the list. Microsoft could have made life a lot easier for programmers by listing registered extensions under one subkey of HKEY_CLASSES_ROOT and registered file types under another.

For each subkey of HKEY_CLASSES_ROOT that represents an extension, Freedom checks whether an internal file-type name exists and if so, whether it is registered with the system. If the subkey is the first reference to a particular registered file type, Freedom gathers and stores information on it and adds the internal name and data object to the file-types list. The utility also gathers and stores detailed information about the extension and adds the extension and data object to the extensions list. That's the overview. Now for the details.

Freedom starts by determining whether an extension has a *New* menu item and if so, whether the item is enabled. If ShellNew is present in an extension's subkeys, the extension appears on the *New* menu. Freedom disables the *New* menu item by renaming the ShellNew subkey to ShellNewQZX, so it also checks for the presence of ShellNewQZX. Sometimes, though, things get more complicated. A ShellNew subkey can appear two levels down, below another subkey whose name matches the extension's internal file-type name. Such a key might look like this: HKEY_CLASSES_ROOT\doc\Word.Document.8\ShellNew. Thus Freedom has to make four different tests to make a determination.

If any other subkeys are present, Freedom flags the extension as having other information. The program then examines any named values assigned to the key, specifically recording the Content Type, if present. If additional named values are present, again the extension is flagged as having other information.

If the internal type name, recorded earlier, is a null string, that means the extension has no associated file type or has a synthesized file type. In the latter case, the file-type information is stored directly below the extension's own key. Freedom checks for the presence of a shell\open\command subkey to determine whether an extension has a synthesized file type.

When the internal type name is not null, Freedom attempts to open the corresponding subkey of HKEY_CLASSES_ROOT. If that fails, the file type is invalid. If Freedom succeeds, it reads the descriptive name of the file type from the newly opened key. The file type may already be present in the list of types. If not, Freedom reads the file type's default icon and open-with command, if present.

After extensions have been processed, the routine cross-links the two lists. Each extension gets the index of its file type in the types list as well as the index of the next extension with the same type in the extensions list. At that point, Freedom has all the information it needs.

WRITING REG FILES

Delphi includes a TRegistry object to give easy access to the system registry, and when I started writing the code to save a given registry key as a REG file, I assumed I would use one or more TRegistry objects. It quickly became clear, however, that the overhead was too great. So I abandoned the TRegistry object in favor of the good old-fashioned Windows API functions RegOpenKeyEx, RegQueryInfoKey, RegEnumValue, RegQueryValueEx, RegEnumKeyEx, and RegCloseKey.

Iterating through all keys and values stored in and below a given key is a lot like iterating through all files and folders starting in a given folder. Freedom's ProcessKey function writes out the full name of the key enclosed in square brackets. The function then calls RegQueryInfoKey to get the number of values and subkeys. A call to RegEnumValue gets each value in turn, and RegQueryValueEx retrieves the data associated with a value. Then ProcessKey calls

itself recursively to process each key returned by the API function RegEnumKeyEx.

The biggest challenge in duplicating RegEdit's output involved writing the data for named values. Windows defines a number of data types for registry values identified by constants whose names start with REG_, and RegEdit writes each type differently. For string values (REG_SZ) RegEdit writes the string itself, in quotation marks, with any embedded backslashes or quotation marks prefixed with a backslash as an escape character. For integer values (REG_DWORD), RegEdit writes *dword:* followed by an eight-digit hexadecimal number. For binary values (REG_BINARY) the program writes *hex:* followed by a series of two-digit hexadecimal numbers, each representing a byte of data, separated by commas. All other types are treated the same as binary values, except that the type number, enclosed in parentheses, follows *hex*. For example, for REG_EXPAND_SZ, RegEdit writes *hex(2):*.

Duplicating the registry editor's output is not quite that simple, though, because RegEdit breaks up the long blocks of hexadecimal data into lines of no more than 80 characters. A backslash at the end of a line serves as a continuation character, and successive lines start with two spaces. If the value name contains any carriage returns or line feeds, the line-length count starts just after the last CR or LF. With much testing and comparison, I was able to come up with a WriteValue procedure that could write any key in the same format RegEdit uses. You'll find it in the source-code unit Regthred.pas.

Freedom of Association found an amazing number of problems with my own system's registered file types and extensions. They're all fixed now, and my *New* menu is nicely slimmed down as well. **PC**

Neil J. Rubenking, the author of Freedom of Association, is contributing technical editor of PC Magazine. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

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User-to-User

BY NEIL J. RUBENKING

Make an HTML List of Favorites

Your issue of February 10 discussed using batch files to generate an HTML file from the Favorites list. One difficulty you note is that "there's no easy way to automate the process of removing URL= from the beginning of the URL lines." My versions of *Makeht.bat* (Figure 1) and *Geturl.bat* (Figure 2) show how to do that. I've also extended the construction of *List.htm* to include clickable text, and I've shown a way to ensure enough environment space for a variable. The two batch files could easily be combined, though at the cost of confusing some people.

MICHAEL DONN
Lakebay, Washington

PC MAGAZINE: As before, these two files should be stored in and run from the Favorites folder, below the Windows folder. After you run *Makeht.bat*, you can immediately load *List.htm* into your browser, without editing, and use it for quick access to your Favorites. You can even make it your start page. And of course, if you make any changes to your list of Favorites, just run *Makeht.bat* again.

You don't have to understand these complicated batch files to use them, but if you're interested, you can learn quite a bit by studying them. The first six lines of *Makeht.bat* serve to ensure that the batch file itself has enough environment space. At the start, the batch file has no command line parameters, so the %1 line does nothing. The next line executes the batch file again under a secondary command processor, with 2,048 bytes of environment space, and passes the string goto:2nd on the command

```

:: MAKEHT.BAT
@echo off
%1
command /e:2048 /c %0 goto:2nd
goto end
:2nd
rem > list.htm
echo set !U!=%1 > url.bat
echo @prompt $LA HREF=" > !!.bat
echo @prompt "$G > !!.bat
echo @prompt $L/A$G$LBR$G > !!.bat
for %%V in (*.url) do call geturl %%V
for %%V in (!!.bat URL.bat) do del %%V
:end

```

FIGURE 1: Run *Makeht.bat* in your Favorites folder to create an HTML document containing links to all your Internet Favorites.

```

:: GETURL.BAT
@echo off
command /c !!.bat >>list.htm
find "URL="<%1%!!.bat
call !!.bat
echo %!U!% >>list.htm
command /c !!.bat >>list.htm
echo %!U!% >>list.htm
command /c !!.bat >>list.htm

```

FIGURE 2: *Geturl.bat* is called by *Makeht.bat* to process each URL file into an active link in *List.htm*.

line. This second time around, the %1 line expands to the command goto:2nd, so execution continues at the label named 2nd.

Now *Makeht.bat* creates several temporary batch files. *Url.bat* contains the line set !U!=%1; this file is the key to eliminating URL= at the start of each URL line in *List.htm*. The files !!.bat, !!.bat, and !!.bat each contain a prompt command that sets the system prompt to a string needed by *Geturl.bat*. The \$L and \$G meta-strings represent the less-than (<) and greater-than (>) symbols in a prompt. Thus these three batch files define the prompts , and
. With the temporary files all ready, *Makeht.bat* uses the for command to pass each URL file to *Geturl.bat*.

Geturl.bat executes !!.bat using Command's /c switch. The output, a single instance of the prompt defined in !!.bat, is appended to *List.htm*. Next it uses find to pull the URL= line from the URL file and redirects that line into !!.bat. When it calls this batch file, the equal sign after URL is treated as a command separator. Thus the file !!.bat calls *Url.bat*, passing the actual URL as a command line parameter. *Url.bat* in turn sets the environment variable !U! to the passed URL.

The rest of *Geturl.bat*'s processing is relatively simple. It appends the URL to *List.htm*, appends the prompt defined in !!.bat, appends the URL again, and appends the prompt defined in !!.bat. The result looks something like this:

```

<A HREF="
http://us.1mdb.com/
">
http://us.1mdb.com/

```

After processing all of the URL files, *Makeht.bat* regains control. Its final act is to delete the temporary files.

Multiple-Target Shortcuts in Windows NT 4

Your November 4, 1997, *Solutions* column indicates that you can't use a shortcut to launch multiple programs under Windows NT and Windows 95. With Windows NT at least, it is possible to create a shortcut that has, for example, the following text in its target field:

```

C:\WINNT\System32\CMD.EXE /c
"explorer.exe&write.exe"

```

This shortcut will launch both *Explorer* and *Write*.

CHRISTOPH NIEVERGELT
via the Internet

PC MAGAZINE: The earlier *Solutions* item demonstrated a technique for indirectly launching multiple programs with a single shortcut, and it is the only solution in Windows 95. The shortcut launches a batch file, which in turn launches two or more programs. The technique described here does almost the same thing, but it uses a specialized ability of Windows NT's command prompt to stack multiple commands.

Under the Windows NT command processor, the ampersand character functions as a command separator. You can string together commands separated by ampersands, and they will all be executed. The example shortcut command shown above actually launches an instance of CMD.EXE, the Windows NT command processor. The /C command line switch indicates that this instance of the command processor should execute the remainder of the command line and then terminate. And the remainder of the command line executes both *Explorer* and *Write*.

You can, of course, use the ampersand command separator when typing commands at a Windows NT command prompt. You can even add a degree of intelligence to your stacked-up command list using two other command separators. If you separate two commands using a double ampersand (&&), then the second command will be executed only if the first command runs successfully. That means it must be a valid command, must run to normal termination, and must not set a nonzero errorlevel on exit. Use a double bar character (||) and the second command will be executed only if the first command fails. True command-prompt aficionados will already be thinking of uses for this odd feature!

Ask Our Advisors

HARDWARE

Portable Transplants?

Is there a way I can upgrade my notebook? I have a 75-MHz 486, and I could use a faster CPU and more memory. What are my options?

PHILIP TEMIYASATHIT
via the Internet

PC MAGAZINE: It is fairly easy these days to add more hard disk space to a notebook computer, but when it comes to CPU upgrades, you have relatively few options. Unlike desktop computers, which use off-the-shelf components, notebooks tend to have highly proprietary designs and components, making it difficult to find upgrade parts.

Some companies do offer CPU upgrades for 80486 notebooks, but these have their limitations. Typically, they are only available for certain CPUs, and you must send in the notebook to a service for the upgrade, which means that you may be without the computer for a week. A CPU upgrade can cost \$400 and up, plus shipping. And when you're finished, you have a used computer with a 5x86 processor that performs about like a Pentium/75, at best.

If you consider a refurbished replacement laptop, you may find it to be a better bargain. For \$900 or less, you can get a Pentium/100 notebook—often with an active-matrix screen, a larger hard disk, and more memory than most 486-based notebooks—and you can often get a warranty on the system as well. The cost may be a few hundred dollars more, but you'll get a complete system that will outperform an upgraded one. You won't have to be without a computer, and you'll end up with two laptops; you can either use the old one for another purpose, keep it around as a backup, or sell it to defray some of the extra cost of buying the refurbished unit.—*Alfred Poor*

OPERATING ENVIRONMENTS

How to Launch Windows Explorer

When you right-click on the Windows 95 Start button on the taskbar, there is a menu that allows you to select Explorer. For some reason, Explorer always opens in the C:\Windows directory, but I rarely need to look at the contents of that directory. Is there a way to make it open in a different directory?

PEDRO J. RESTREPO
Boulder, Colorado

PC MAGAZINE: Dozens of readers wrote in with similar questions after reading the April 8, 1997, Solutions column, which detailed a method for controlling Windows Explorer's initial folder display. All of these readers were in the habit of right-clicking the Start button and choosing *Explore* to launch Windows Explorer. And all of these readers were victims of a common misconception. Selecting *Explore* from the Start button's right-click menu is not a general-purpose way to start Explorer!

When you right-click the Start button, one of the menu items is *Explore* (not *Explorer*). By selecting this item, you are asking to explore the Start menu folder itself. Windows Explorer comes up showing the Start menu folder. The submenus of the Start menu are folders in this view, and the menu items are shortcuts within the folders. The purpose of choosing *Explore* from the Start button's right-click menu is to rearrange items in the Start menu. If you think about it, you'll realize this makes sense. In general, if you right-click an object in Windows 95 and get a menu, this menu contains commands specific to the object you right-clicked. Right-clicking any folder, including the Start menu folder, gets you a menu of commands for working with that folder.

The only time you can control Explorer's initial display is when it's launched from a Start menu item or other shortcut. In that situation, you have full control of the command that launches Explorer, and you can apply the earlier Solutions tip to control the folder that Explorer initially displays.

—*Neil J. Rubenking*

WORD PROCESSING

Picture Centering in Word 97

Is there an easy way to center a picture across the page in Microsoft Word 97? Unless I'm misremembering, this was easy to do in Word 95. The only way I've found to do it in Word 97 is to open the Format Picture dialog box and manually enter the horizontal position. This is more than a little clumsy, since you first have to calculate what that position should be.

JOSEPH GRUBER
via ZDNet

PC MAGAZINE: In Word 95 you can insert the picture into a frame, then define the frame as horizontally centered. Once you've inserted the picture into a document, you frame it by

clicking on it and choosing *Insert | Frame*. To center it, you select the picture, choose *Format | Frame*, in the *Horizontal* box set *Position* to *Center*, and set the *Relative To* option to *Margin, Page, or Column* as appropriate.

Word 97 doesn't use frames. Instead, the program lets you define inserted pictures to float over text or not. If a picture is set to float over text—the default—it behaves the way a picture in a frame does. You can drag it anywhere on the page, but there is no option to center it horizontally. There is, however, a workaround.

First, select the picture by clicking on it, choose *Format | Picture* and then *Position*, remove the check from the *Float over text* check box, and choose *OK*. Next, make sure the picture is in a paragraph by itself, without any text or spaces. Set Word to show all nonprintable characters to be sure.

Format the paragraph as centered by hitting Ctrl-E, clicking on the *Center* button on the formatting toolbar, or choosing *Format | Paragraph*, then selecting *Indents and Spacing*, and setting the alignment to *Centered*.

The picture will now be centered relative to the column it's in and relative to the margins if you're using a single-column format, which is

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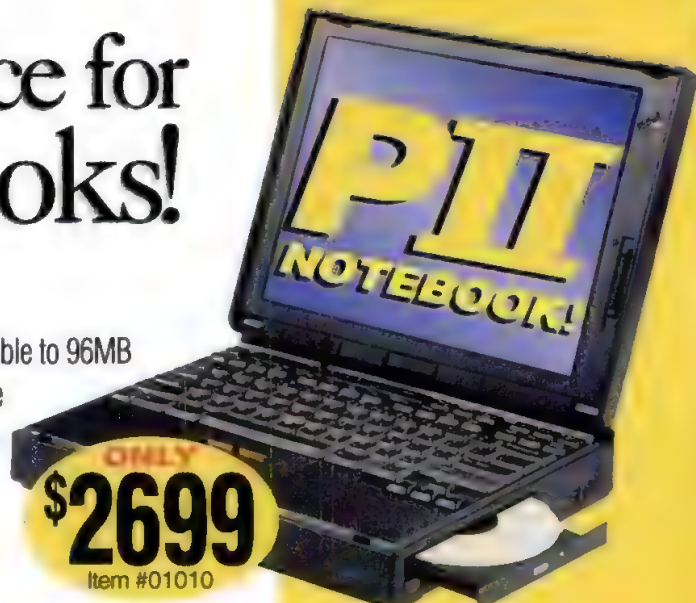
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what I'll assume for the moment. If you want to center it relative to the page, select the picture, then redefine the left and right paragraph margins to 0. You can do this either by dragging the left-indent and right-indent markers to the edge of the page, or by choosing *Format | Paragraph*, then selecting *Indents and Spacing*, and entering minus values for the left and right indents. For example, if the page layout is defined with a 1-inch left margin and a 1.5-inch right margin, you would enter -1 as the left indent for the paragraph and -1.5 as the right indent.

Centering the picture this way will serve only if you don't want text to wrap around the picture and don't need to adjust the vertical position. If you need either of those capabilities, you'll have to set the picture back to float over text. The picture will keep its centered position when you reset it under most conditions, unless it's embedded, as it will be if you inserted it though the *Insert | Picture | Clip Art* command.

To see if the picture is embedded, hit Alt-F9 to toggle between seeing field codes and seeing field code results. If the picture changes to a field that starts with the word *Embedded*, it's embedded. To convert it to an inserted picture, place the cursor in the field or toggle Word back to show field results and select the picture, then hit Ctrl-Shift-F9. This will unlink the field and insert the picture, so if you hit Alt-F9 again, the picture will no longer change to a field.

To set the picture back to float over text, select the picture and choose *Format | Picture*, then *Position*. Add a check to the *Float over text* check box, and choose *OK*. With the Shift key held down you can drag horizontally or vertically without losing centering in the opposite axis.

There's an additional complication if you're using a multiple-column text format. Formatting a paragraph as centered will center it within the current column. To center it relative to the margins, you'll have to create a one-column section for the picture. Select the picture, choose *Format | Columns*, choose *One*, make sure the *Apply to* box says *Selected Text*, and choose *OK*. Word will add a section break before and after the picture.

You can now center the picture horizontally and set the text wrapping around the picture using the techniques I've already described. If you leave the section breaks in place, however, you'll find that Word changes how it lays out the text on the page, putting all the text that comes before the section break in multiple columns above the section break, instead of letting the text continue along the leftmost column. To return the text layout to its original

position, first set the picture back to *float over text*, as already described, then delete the two section breaks that Word inserted. The picture will remain centered, and the text will return to its original layout.—*M. David Stone*

SPREADSHEETS

Excel 97 Recalc Bugs

I have discovered two serious bugs in Microsoft Excel 97 that I think your readers should know about. These bugs cause worksheets to return inaccurate results. Here are the steps to reproduce the first bug:

- Enter 10 into A1.
- Enter 20 into B1.
- Enter 30 into C1.
- Enter =SUM(A1:C1) into D1.
- Select A1:D1 and fill through row 10. (Do this in one step.)
- Insert a new row at row 6.
- Select A5:D5 and fill to row 6. (Do this in one step.)
- Change C1 to 5.
- Select C1 and fill to row 11.

The result in D11 is still 60 but should be 35.

Follow the steps outlined below to reproduce the second bug:

- Enter 1 into A1.
- Enter =A1 into B1.
- Enter =B1 into C1.
- Enter =SUM(A1:C1) into D1.
- Enter =A1+1 into A2.
- Enter =A2 into B2.
- Enter =B2 into C2.
- Enter =SUM(A2:C2) into D2.
- Fill A2:D2 down more than 16 rows.
- Change A1 to any number.

The result is that some of the cells below A2:D2 are not updated correctly.

BECKY HOFFMAN
Charlottesville, Virginia

PC MAGAZINE: Microsoft has acknowledged the first of these bugs and published a partial fix at www.microsoft.com/excel/default.asp. The fix is a small executable that patches Excel.exe. Note, however, that you must be using the SR-1 version of Excel 97 for the patch to work. If you don't have SR-1 yet, you can get that from Microsoft's Web site as well.

The patch does not correct all occurrences of the problem, however. Microsoft has promised to deliver another patch in April (by the time you read this), presumably at the same Web site.

As for the second bug, Microsoft appears to believe it's related to a problem that was first reported last autumn and that was addressed by the combination of the SR-1 update to Microsoft Office and a recalc patch that was posted at that time. You can download both SR-1 and the patch. I'll warn you, though, I have tried this solution and found that the bug remains!

Until these problems are cleared up entirely, you can make sure your worksheets are recalculated correctly by using the undocumented keyboard shortcut Ctrl-Alt-F9. Because you probably won't want to do that every time you add or change data, here's a simple macro solution that will work for all new workbooks:

1. Create a new workbook.
2. Press Alt-F11 to get to the Visual Basic editor.
3. In the project window, double-click *This Workbook* (it's located under *Microsoft Excel Objects*).
4. At the top of the code window are two drop-down lists. From the list on the left, choose *Workbook*. From the list on the right, choose *SheetChange*.
5. The line

```
Private Sub Workbook_SheetChange  
(ByVal Sh As Object, ByVal Target As  
Excel.Range)
```

appears in the code window. Below this line type the following:

```
SendKeys "^%{F9}"
```

6. Return to Excel and choose *Save As* from the *File* menu.
7. From the *Save as Type* drop-down list, choose *Template*.
8. Navigate to your Xlstart directory and save the file under the name *Book* (Excel will add the extension .xlt).

Your Xlstart directory is located directly below the directory containing Excel.exe. By default, the location is C:\Program Files\Microsoft Office\Office\Xlstart. At start-up, Excel automatically loads any files that it finds there. If there's a template called *Book*, that template serves as the model for all newly created workbooks.

The Sendkeys macro simply sends a Ctrl-Alt-F9 keystroke combination to Excel after every change to your workbook. If you try the steps for reproducing Ms. Hoffman's bugs in a workbook protected by this macro, you'll find the bug effectively neutralized. This will not protect existing workbooks, however. For

PCTech Ask Our Advisors

```
Public Function SetDefaultFindReplaceBehavior(intOption
As Integer) As Variant
'*****
' Function SetDefaultFindReplaceBehavior(intOption As
Integer) Access 97
'
' Sets the default Find/Replace behavior in the Tools,
Options, Edit/Find
' dialog. intOption is zero based and corresponds to
the choices available
' in the dialog. This function returns the previous
value.
'*****
On Error GoTo SetDefaultFindReplaceBehaviorErr
'Specify error handler

SetDefaultFindReplaceBehavior = _
```

```
Application.GetOption("Default Find/Replace
Behavior")

Application.SetOption "Default Find/Replace
Behavior",
intOption

SetDefaultFindReplaceBehaviorExit:
Exit Function

SetDefaultFindReplaceBehaviorErr:
MsgBox ("Error number " & Err.Number &
": " & Err.Description)
Resume SetDefaultFindReplaceBehaviorExit

End Function
```



FIGURE 1: You can use the function shown here to set the default find/replace behavior in your Microsoft Access 95 or 97 database programmatically.

those, you'll need to re-create the Sendkeys macro, following steps 1 through 5 above.

Note that these bugs affect only Excel 97. The problems do not exist in earlier versions.
—Craig Stinson

DATABASES

Changing the Default Find Behavior in Access

When you select the Edit menu and choose Find, the resulting dialog offers the Find What, Search, and Match selections. The default choice in the Match selection is Whole Field. I think it would be more logical to use Start of Field as the default. How can I change the default value?

GEORGE SMITH
via the Internet

PC MAGAZINE: To change the default *Match* selection in Microsoft Access 97 or Microsoft Access for Windows 95, select the *Tools* menu and choose *Options*, then select the *Edit/Find* tab. Choose either *Fast Search*, *General Search*, or *Start of Field Search* as your default, then choose *OK* to save your changes. When you change the default, the change won't take effect until the next time you start Access.

Note that the change is global and will affect any database you open. If you want the change to apply only to a specific database, you should set and restore the find/replace behavior setting programmatically, using the function shown in Figure 1.

When your application starts, you can call this function once to change the find/replace default to your preferred setting. A good

place to make such a call is the Open event procedure of your main form. Later, when you exit your application, you can call the function again to restore the find/replace default to the original setting. A good place for this call is the Close event procedure of your main form. In order to avoid hard-coding the value to restore, you might want to create a public variable to hold the original setting. For example, you could place a public declaration in a module in your database like this:

```
Public varSaved As variant
```

You would then include a call to *SetDefaultFindReplaceBehavior* in the Open event procedure for your main form. This sets the default behavior to the *Start of Field Search*, or third, option (third because the three choices are 0, 1 and 2):

```
VarSaved =
SetDefaultFindReplaceBehavior(2)
```

To restore the setting when you quit the application, you would simply place the following call in the Close event procedure for your main form:

```
SetDefaultFindReplaceBehavior
(varSaved)
```

If you're using Microsoft Access 2, there's no way to alter the default setting. Your best bet is to create a macro that you run whenever you want to use the *Find* dialog. The macro uses the Sendkeys macro action to place the required keystrokes in the keyboard queue and then the DoMenuItem action to open the *Find* dialog. The keystrokes must do the

following: switch to the *Where* drop-down menu (Alt-H), select *Start of Field* (S), and then switch back to the *Find What* text box (Alt-N). Thus the macro has the following components:

```
SendKeys Action
Keystrokes: %hS%n
Wait: No

DoMenuItem Action
MenuBar: Form
MenuName: Edit
Command: Find
```

You use the macro by opening the form or datasheet you wish to search, then selecting the *File* menu, and then choosing *Run Macro*.
—Sal Ricciardi

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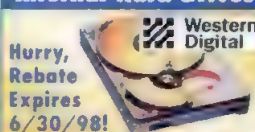
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200/MMX 32MB 2 1GB 24X	1148.28
200/MMX 32MB 2 1GB 24X	1157.58
233/MMX 32MB 3 2GB	917.26
233/MMX 32MB 3 2GB 24X	1088.56
233/Pi 32MB 4GB	1247.36
233/MMX 32MB 4GB 24X	1247.36
233/Pi 32MB 4GB 24X	1467.88
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HP VE 4 Series mini-towers

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HP VL 7 Series desktops

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266/Pi 64MB 4 3GB 24X	2008.78
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HP VL 7 Series mini-towers

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233/MMX 32MB 4 3GB 32X	867.10

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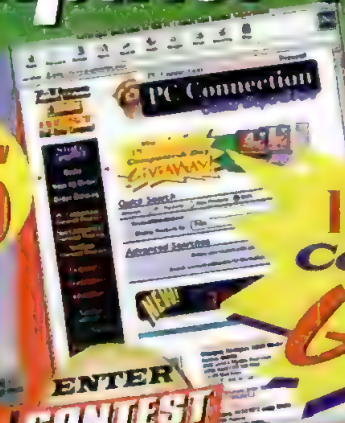
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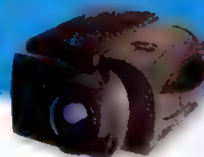
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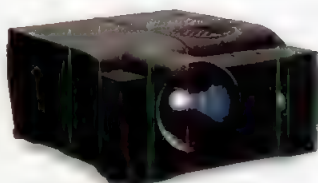


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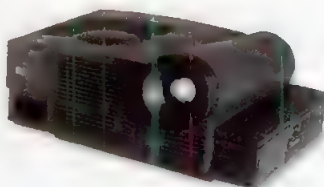


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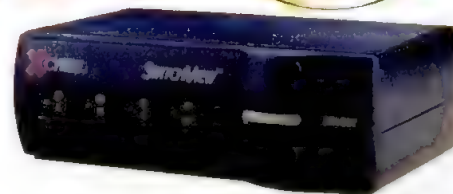
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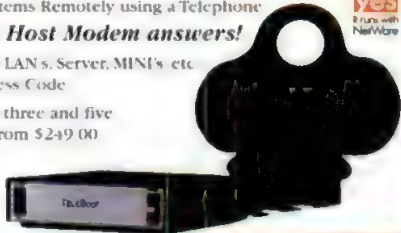
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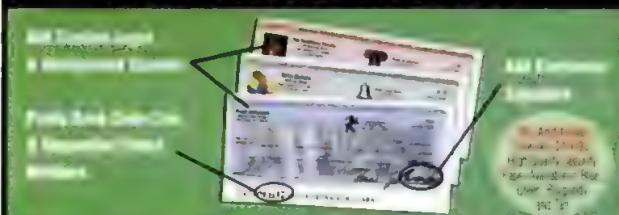
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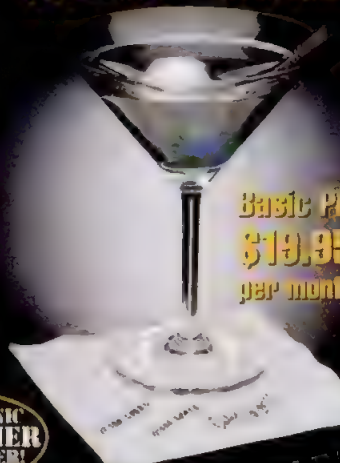


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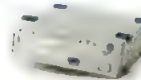
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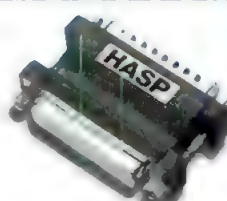
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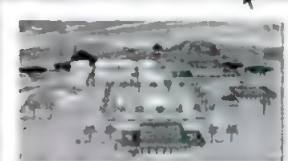
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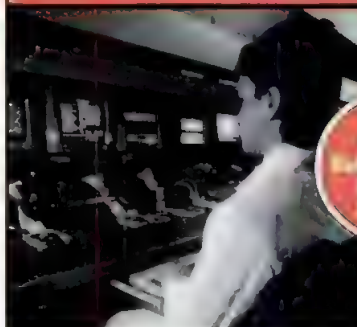
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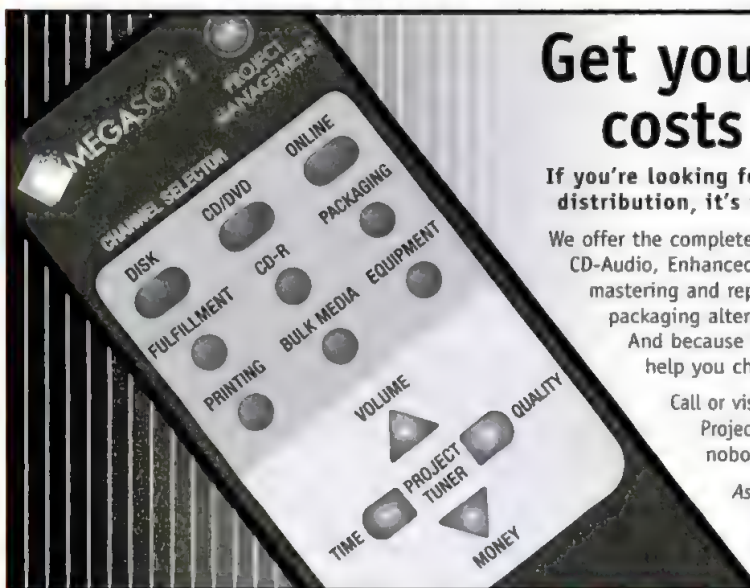


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Four programs to help you put your best foot forward and land that new job.

By Jennifer Triverio

Career changing, company downsizing, or stepping up the corporate ladder—all serve as occasions to dig out the old résumé and give it a major overhaul. Fortunately for those who viewed English class as a time to catch up on sleep, programs are available that take care of everything from formatting your résumé to providing those all-important eye-catching power words and phrases. The four programs we tested all provide interview tips and career-planning tools as well.

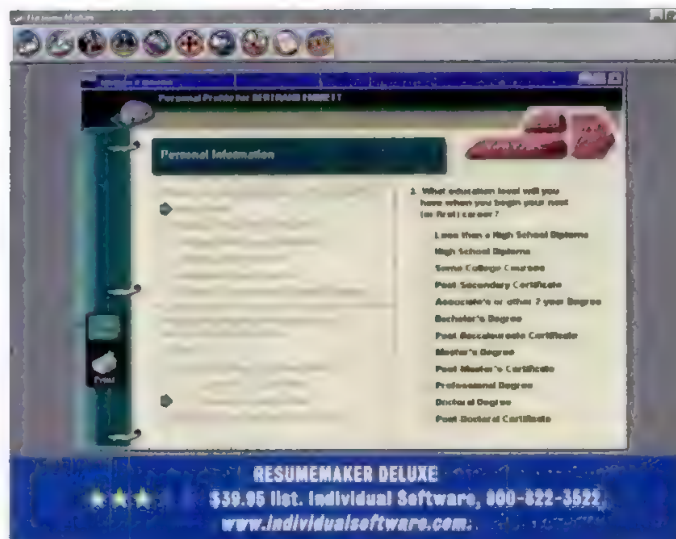
In recent years, the Internet has become a noteworthy addition to the conventional job search, with online classified ads and job databases serving to augment traditional networking outlets. In a future issue, we will take a look at the

pros and cons of conducting a job search online and review sites such as Resumail (www.resumail.com), a free service that matches job seekers with prospective employers.

The Perfect Résumé

The Perfect Résumé, from Davidson & Associates, is the granddaddy of résumé programs, having first appeared in March of 1994. The program has since been enhanced, but its age shows. The three other programs in this roundup offer integrated Internet access to complement their resources; The Perfect Résumé does not.

The Internet aside, if you need a program to help you generate a top-notch résumé, this program gets the job done skillfully. The exhaustive and



accessible help system makes The Perfect Résumé especially suitable for recent graduates and those preparing résumés for the first time. The program includes video clips hosted by career consultant Tom Jackson and text discussions for almost every topic in the help section.

You can create a résumé by selecting from the chronological, functional, or targeted formats, or you can go the quick-and-dirty route and choose Résumé Express. This option presents you with a series of questions and uses your answers to format a résumé. You then go to Résumé Builder and add details such as your address and phone number.

The Power Letters section gives you dozens of cover and follow-up letter templates. You just fill in the blanks—Mad Libs-style—with the specifics of the job for which you are applying. Job Search Manager can help you keep track of the companies you contact.

In addition to its lack of Internet resources, the program is missing some niceties that would have made it easier to use. For instance, no pop-up descriptions appear on the toolbar icons, so you may have trouble figuring out what some of them represent without con-

INSIDE

THE LAND BEFORE TIME

Explore lost civilizations in The Journeyman Project 3: Legacy of Time. Page 322.

FREDDI MAKES A SPLASH

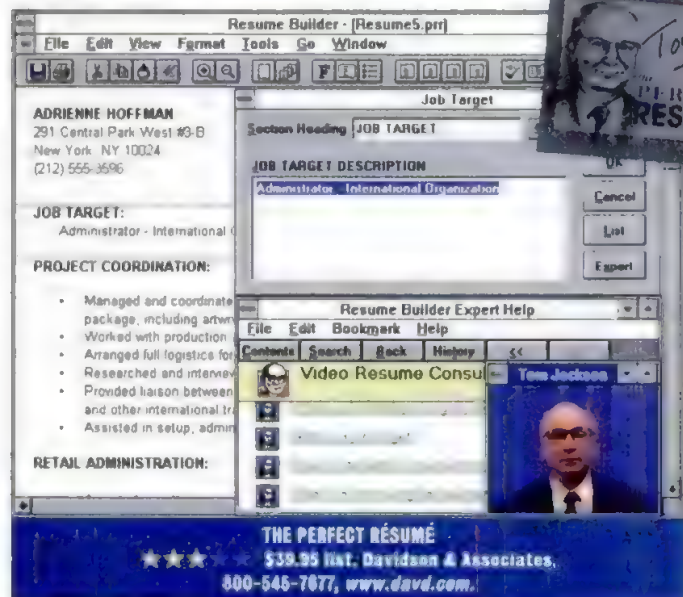
In the third installment of Humongous's game, Freddi Fish does just swimmingly. Page 324.

LAYING DOWN THE LAW

Outstanding graphics define G-Police, an intense action game. Page 324.

WE ARE NOT ALONE

Get inside the heads of agents Scully and Mulder with the "X-Files" CD-ROM. Page 327.



After Hours

sulting the manual. Each section you work on opens in a separate window, so that halfway through writing your résumé you'll have several windows open.

Even with its shortcomings, you'd be offering sage advice if you steered recent graduates toward The Perfect Résumé.—JT

ResumeMaker Deluxe

ResumeMaker Deluxe from Individual Software works harder to help job seekers use the power of the Internet. Job Finder and Resume Caster are the program's Net-savvy components.

You need Internet Explorer 4.0 to take advantage of Job Finder. From within ResumeMaker Deluxe, type the career you're pursuing and the geographical area you'd like to search and you'll get the latest postings from some 20 Internet job-search engines. With Resume Caster, you can e-mail your résumé to any employers your search turns up and add the job description and contact information into the program's contact manager.

Career Planner is a helpful aid for graduates and folks in midlife crisis alike. It substitutes as a career counselor, helping you rate your strengths, weaknesses, and preferences, then serving up a list of careers that might fit you. Additional tutoring options abound, including the Virtual Interview feature, Q&As, and Expert Advice videos (which could really use some livening up). You can print out the program's handy Top 25 Tips lists on items such as salary negotiation, benefits, and interview strategies.

The Guided Resume feature has you enter text into pop-up boxes called *cards*. You can energize your résumé by

using the list of action words and phrases. You can choose template styles, which range from chronological and functional résumés to performance, skill, and recent-graduate résumés, as well as résumés for 250 different careers. We were bothered by small inconveniences: Some icons in the guided activities boxes are not intuitive, for example.

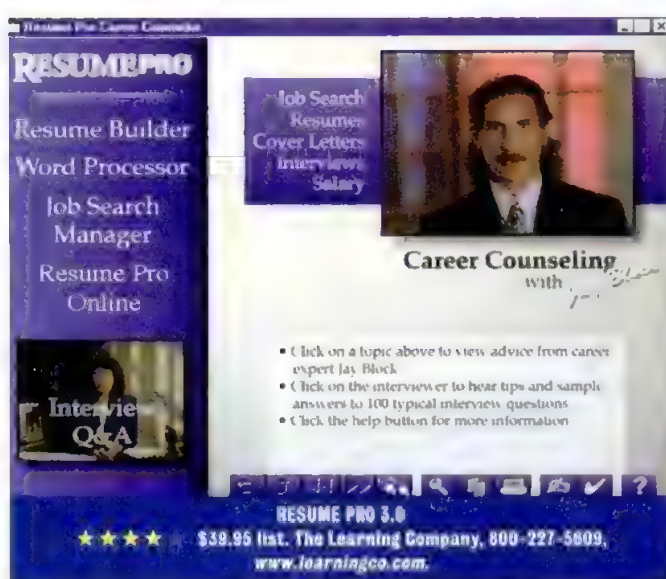
ResumeMaker Deluxe earns well-deserved kudos for its tight integration with online job-hunting sources. That's a real plus, as job searches become ever more driven by the Web.—Bertrand Emmett

Resume Pro 3.0



Resume Pro 3.0, from The Learning Company, is the way to go if you have already done your fair share of résumé writing and don't need to have your hand held. The program still includes the requisite Multimedia Career Counselor and Interview Q&A but offers you more control over the process of creating your résumé than the other programs we review here.

Resume Pro looks and works like a standard word



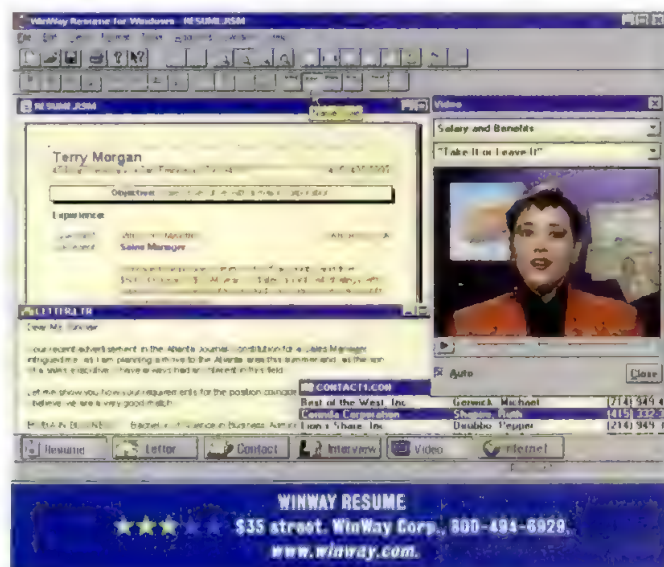
processor. You provide your basic information: The Resume Wizard can walk you through this section, or you can enter the information on your own. Then you edit the résumé directly, without having to deal with the pop-up dialog boxes found in most programs. In addition to Resume Pro's word processor-like interface, there is an actual word processor in the program for creating cover letters and envelopes (you can import address information from the Job Search Manager).

The well-labeled icons guide you to dozens of layout, font,

and style possibilities. Integrated into the word processor is a keyword and action-word glossary, a list of buzzwords for different industries.

Once you complete your résumé and cover letter (you can create your own or use one of the more than 100 samples provided), you have several options for getting your story out to the world. Of course, you can simply save and print, but you can also save the résumé in OCR format for scanning (onto your Web page, perhaps) or use the step-by-step guide for posting it on the Internet. The program has a one-click link to the Internet, where you can post your résumé on the Resume Pro site or connect directly to job databases.

The only annoyance we found was that by the time you have finished your résumé, your desktop will be littered with open windows. But that's a small price to pay for using Resume Pro 3.0.—JT



WinWay Resume 4.0

Job hunters seeking tools to help format résumés and tailor job descriptions will get a boost from WinWay Resume 4.0. It adds a Fit to

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"DeLorme Street Atlas USA provides the best navigational tools. The leading products are closely matched in many areas, but DeLorme's robust support of satellite navigation and automatic route creation make this well-balanced program the best choice." —National Software Testing Labs

Choose 022 at www.pcmag.com/infolink



After Hours

Single Page option, a database with details on 12,000 occupations, and easy access to career resources on the Internet.

Fit to Single Page, which condenses or stretches your résumé to fit one page, is a real help. Formatting the various elements of your résumé is fairly foolproof; click on style icons at the top of the screen to try different looks.

Tinkerers may prefer to export their résumés to a word processor for fine tuning: You don't edit text directly on the page in WinWay Resume; instead, you have to use dialog boxes, so you need a program such as Microsoft Word to finesse details like line spacing.

WinWay regularly updates its online resources and points you to major Internet job databases, and it offers helpful career-planning advice. Also,

you can e-mail your résumé from within the program.

Features from previous editions include AutoWriter, which supplies power phrases, and video tutorials to clue you in about what to say and do on your résumé and during interviews. If you do nothing else in the interview simulation, review the Salary and Benefits Q&As to learn the right ways to handle employers' compensation queries.

We wish more attention had been paid to some details. For instance, the program doesn't format phone numbers automatically, so you must remember to be consistent. Also, in a very few instances, clicking on automatic style icons caused some portions of text to overlap with others. These quibbles aside, WinWay 4.0 can help you create a professional-looking résumé.—BE

Back in Time

Legacy of Time is a throwback to a time when storytelling was an art.

Atlantis, El Dorado, Shangri-La: Three fabled cities guarded the secret of an ancient alien race, a secret that led to their destruction. If that sounds like the plot for any number of feeble CD-ROM titles, you're in for a surprise. Red Orb Entertainment's *The Journeyman Project 3: Legacy of Time* is that rare triumph, an intensely enjoyable game with breathtaking environments.

Playing as Gage Blackwood, an agent for earth's Temporal Security Agency in the year 2329, you discover that alien visitors have battled throughout the planet's history. Only through time travel can you recover the hidden objects they sought and save time itself.

Along the way, you have to trust the enemies from previous adventures: Dr. Elliot Sinclair, the inventor of time travel, and the rogue TSA agent Michelle Visard. (The game is third in a series, but knowing the first two isn't essential.)

You travel by donning a time capsule called the Chameleon JumpSuit, which lets you mimic the identity of anyone you've encountered. Along for the ride is Arthur, the shipboard computer. Arthur keeps things light by cracking terrible jokes.

In addition to the game play, video sequences flesh out the plot. *Legacy of Time* features unusually good acting as well as great sets and special effects.

QUICK CLIPS

Sub Culture

Explore the depths of the ocean in a miniature submarine and enjoy the spectacular 3-D environments of this adventure game, in which you'll battle mutant fish, pirates, and other subs. \$49.95 list; UbiSoft, 800-824-7638.

Thinkin' Things Sky Island Mysteries

Problem-solving and critical thinking exercises were never this much fun when you were young. Designed for kids aged 8 to 12, *Sky Island Mysteries* features hundreds of puzzles and drills. \$29.95 list; Edmark, 800-691-2985.

Grand Theft Auto

It's not that the goal is to work your way up in the mob by killing cops and stealing cars that turns us off. It's the repetitiveness and annoying overhead perspective that kill this game. \$49.95 list; ASC Games, 203-655-0032.



Calendar Creator 5.0

Get a grip on your hectic schedule with this handy CD. New features include an integrated address book, PalmPilot compatibility, and lots of customization options. \$50 street; The Learning Company, 800-227-5609.

But what really makes *Legacy of Time* stand out is the detailed, 360-degree panoramic environments. The level of detail is amazing. Even such little things as ripples in water or light through a window look true to life.

If you've always feared that games of this sort would be too difficult or complex, don't worry. Arthur the computer has

hints to solve almost every puzzle. We recommend that you don't ask him unless you're really stuck, though, or you'll finish this stunning four-CD-ROM set far too quickly.

Legacy of Time goes the extra mile in every way, immersing you in believable, fantastic cities. Red Orb has another hit to its credit. —Troy Dreier



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Under the Sea

Freddi Fish will make a huge splash with the kids in her latest adventure.

Freddi Fish 3: The Case of The Stolen Conch Shell

Freddi Fish is the Moby Dick of the kids' software market. The legendary little yellow fish, who is never at a loss for words on the importance of friendship, has earned legions of young fans with her two previous adventures. She will certainly win a lot more fans with Freddi Fish 3, a game that proves that nobody understands kids like Humongous Entertainment.

This time, Freddi and her wisecracking pal Luther visit Luther's Uncle Blenny for the annual Founder's Day

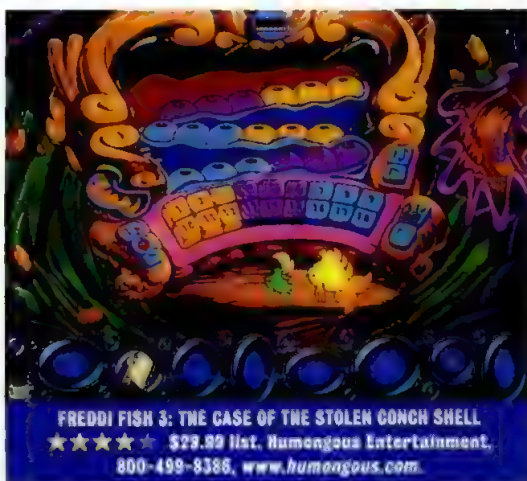
Festival. Once they arrive, they find that the great conch shell has been stolen and Uncle Blenny is in jail as the prime suspect. Freddi and Luther must interview six other suspects and recover the shell so the festival can begin.

Every step of the way, the Humongous designers demonstrate their considerable experience at kid gaming. Freddi Fish 3 is entirely point-and-click-based, requiring no dragging or keyboard commands. Also, each screen has lots of hot spots, each of which produces a funny action sure to make youngsters giggle. The game changes a little

each time you play it, offering new clues and culprits. And stars from other Humongous games, including Pajama Sam and Putt-Putt, drop in for brief cameos.

What really impressed us was the three activity screens along the way—a picture maker, a playable carnival organ, and a Tetris-like game—which can be enjoyed long after the case is solved.

The only thing the game lacks is a few more scenes. Maybe the designers could have found room if they had pared down the seven interactive demos for other Humongous games. Otherwise, the game is a winner. Prepare to be thanked over and over as your young friend laughs along with Freddi and Luther.—TD



Wreaking Havoc

Immerse yourself in corporate espionage and murder in this 3-D flight shooter.

Near the end of the 21st century, the earth has survived a world war over the last remaining natural resources. Multinational corporations have formed an alliance to control what's left of the earth and exploit the rest of the galaxy.

Grim? G-Police, from Psygnosis, makes no excuses, placing you in the thick of the action. You're the unseen Jeff Slater, a pilot and member of G-Police, a special-forces group created to keep this entrepreneurial empire in check. The real star of the game, however, is your Havoc jet gun ship. With 360-degree flying freedom, you'll take this craft on 35 missions

(there are also 5 secret ones) within domed urban environments on a Jupiter moon. Your goal is to uncover the greedy and malevolent nature of the corporations and unearth the truth about your sister's mysterious death.

G-Police is optimized for all major 3-D graphics accelerators, and we would suggest investing in one for best results. We began our game play on a Pentium MMX/233 with 32MB of RAM and a 4X CD-ROM

drive with a Number Nine Reality 334 2-D graphics card (the recommendation is for a Pentium/166 or better, 32MB of RAM, and a 4X CD-ROM drive). The game was sluggish and murky. We then ran two tests, one with a Number Nine Revolution 3D card and the other with a Matrox Mystique 3-D card. With the 3-D boost, G-Police was rejuvenated. The

game moves quickly and smoothly with 3-D acceleration, highlighting beautiful dark-toned hues and rich 3-D textures. The lighting effects from crashes and explosions are fabulous.

But in a shooting game, powerful weapons are as important as great graphics. And G-Police has them. The weaponry provides more than

enough muscle for battling AI enemies.

G-Police could use a few more environments and better lighting in some of the scenes; certain areas are too dark. But beyond those minor aspects, G-Police plays well and has a great story line and look. This game raises the bar in the 3-D PC game market.—Roderick A. Beltran



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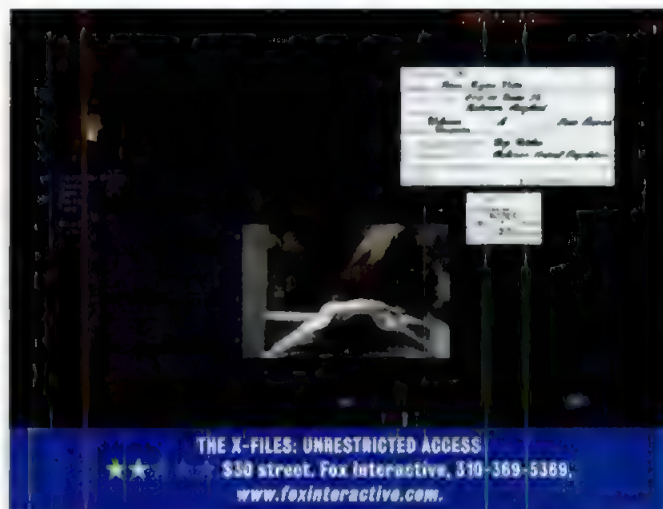
What do you get when you combine arguably the greatest TV series of the 1990s with weak multimedia content? Simply, a pretty disappointing CD-ROM.

This disk tries to imitate the feel of "The X-Files" by having you pretend you're covertly accessing computer files that reveal details about the show. Once you manage to get past the needlessly painful installation, you feel immersed in the "X-Files" motif, with mood music, dark palettes, and haunting graphics.

But just as in any good "X-Files" episode, all is not what it seems to be. For starters, a sub-

menu lets you get to know the show's main characters. But when you click on, say, Deep Throat, the window of information regarding the character opens behind the submenu and can't be seen without first closing the entire submenu.

If you can decipher the cryptic interface to find case files, you'll also find information on every episode, along with evidence, photos, and video clips. The title offers access to a supersecret Web site that gives you the latest information on the most recent episodes. In view of the dated material on the disk, this is a welcome feature. But when we



visited the site, there was no new material. That is not to say our investigation proved fruitless. The site has a Surveillance Camera feature that allows you a panning view of the show's more famous locations. With QuickTime VR, you can roam around Mulder's bedless apart-

ment or Scully's dwellings.

In the light of the cutting-edge quality of "The X-Files" and the intelligence of its audience, this CD-ROM is remarkably lacking, with its awkward interface, dated material, and unfulfilled features. Case closed.—Shane Mooney

Coming Up

What's in the Next Issue of *PC Magazine*

What Does the Perfect PC Look Like?

You'll know soon. After considering the thousands of PCs and PC-related products that came through our Labs in the past year, we give you our take on what constitutes the perfect system—for the business desktop, for the road warrior, for the home, and for the server room. We drill down on the components, so you'll have clear guidelines as you prepare for your next purchase. It's all in there—and more.

The Perfect Network

We have a series of guidelines for you on putting together the perfect network—whether it's an enterprise system with an intranet, a workgroup LAN, or a small-office or even a home network. We include a look at the perfect server and the perfect network adapter and hub.

PC Service & Reliability; Software Support & Satisfaction

We asked thousands of our readers to tell us whether they like their recent PC purchases and the software they're running. Who supplies the best PC technical support? Just how popular is Windows NT? Find out in our July issue.



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Asante FriendlyNET FS40008DS AsanteTechnologies Inc.....	232/908	Novatel Contact Novatel Wireless Inc.....	45/418
ATI CentreCOM AT-FS708 Allied Telesyn International.....	230/907		
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Cassiopeia E-10 Casio Inc.....	45/413	Olympus FlashPath Olympus America.....	68/403
CA-SuperProject 4.0 Computer Associates International Inc.....	211/550	Omnicom 3Demon MX16/16 Omnicomp Graphics Corp.....	206/505
Chart FX 3.0 Software FX Inc.....	254/561	On Target 2.0 Franklin Covey Co.....	214/556
ChartPro 2.0 Sub Systems Inc.....	254/562		
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D-Link DES-3208 D-Link Systems Inc.....	228/903	Project Scheduler 7 Scitor Corp.....	216/552
DTK APRI-76M/P333 DTK Computer Inc.....	159/521		
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EndNote 3.0 Niles Software.....	73/406	RouteFinder GPS for Windows 95 2.0 Datus Inc.....	76/405
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Everex StepStation 2 Model PII333 Everex Systems Inc.....	160/522		
Extensis Mask Pro 1.0 Extensis Corp.....	61/408	SAG STA 350 SAG Electronics.....	173/540
Extensis PhotoTools 2.0 Extensis Corp.....	60/408	Sequel Net Access Manager 4.0 Sequel Technology.....	240/921
		SIA P6/333-Pentium II Mid Tower SIA Computer Corp.....	174/541
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Micron ClientPro 400 Micron Electronics Inc.....	168/530		
Microsoft Project 98 Microsoft Corp.....	212/551	Zenon Platinum NLX4 Zenon Computer Systems Inc.....	189/548

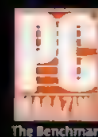
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ADVERTISERS' INDEX BY COMPANY

InfoLink No.	Advertiser	Page	InfoLink No.	Advertiser	Page	InfoLink No.	Advertiser	Page
134	01 Communique Laboratory Inc.	252	*	IBM Corporation	148-149	014	Paragon Memory	284
*	3 Com Corporation	54-55	084	iiyama North America	44	047	PC Connection	288-289
*	3 Com Corporation	238	184	iiyama Direct	86	330	PC Mall	278-279
030	A.T. Cross Company	77	390	In Focus Systems	78	080	PC Power & Cooling Systems	88
101	ATI Technologies	203	171	Innovative Software	39	068	PC Zone	277
087	Acer America	169	278	Insight	220	151	Philips Electronics	65
092	Acer America	205	*	Intel Corporation	53	032	Philips Electronics	326
*	Adaptec	318	*	Intel Corporation	66-67	293	Play Inc.	57
*	Adobe Systems Inc.	69	*	Intel Corporation	229	176	PowerQuest Corp.	8
*	Advanced Recognition Technologies	14	295	J&R Computer World	282-283	148	Primavera	208
161	AIWA America	323	106	Kingston Technology Corporation	20	287	ProGen	98-99
342	American Power Conversion	25	019	L.A. Trade	292	024	QMS	235
*	Anthro Corporation	94	094	Lexmark International Inc.	31	074	Quantex	119-121
212	ADOpen Inc.	262	367	LG Electronics USA	153	205	Ricoh Corporation	124
*	Autodesk Inc.	50	194	Macromedia	259	127	Ringdale	236
*	Compaq Computer Corporation	74-75	039	MAG InnoVision	18-19	309	S.A.G./Storage Solutions	243
*	CompUSA PC	92	381	Matrox Graphics Inc.	200-201	033	SMC	242
348	Computer Associates	247	191	Meridian Data	241	374	Seagate Software NSMG	233
360	COMPUTER DISCOUNT WAREHOUSE	165	027	Micro Solutions Computer Products	293	227	Shamrock Technology Co., Ltd.	270
159	COMPUTER DISCOUNT WAREHOUSE	166-167	003	Micro Warehouse	290-291	229	Silicon Intergrated Systems	265
133	COMPUTER DISCOUNT WAREHOUSE	250-251	164	Micron Electronics	15	284	Smart and Friendly	332
158	COMPUTER DISCOUNT WAREHOUSE	285	098	Micron Electronics	16-17	073	South Hills Datacomm	237
109	COMPUTER DISCOUNT WAREHOUSE	286-287	120	Micron Electronics	48A-49	057	Statsoft	43
011	Corel Corporation	257	119	Micron Electronics	139-142	023	Sun Microsystems	5
203	Crucial Technology	34	013	Micron Electronics	181-187	335	Sun Microsystems	113
333	D-Link Systems	224	*	Microsoft	C2-C4,p1	*	Symantec Corporation	131
051	Data Comm Warehouse	249	*	Microsoft	58-59	*	Symantec Corporation	248
*	Dell Computer Corporation	C5-C8	*	Microsoft	134	315	Syquest Technology	95
*	Dell Computer Corporation	22-23	221	Mita Copystar	261	*	Texas Instruments	155-157
*	Dell Computer Corporation	90-91	*	Mitsubishi Electronics	123	066	TigerDirect	333
*	Dell Computer Corporation	171	156	NEC Computer Systems	2-3	378	Toshiba	26-27
*	Dell Computer Corporation	196-197	154	NEC Computer Systems	80-81	377	Toshiba	144-145
022	Delorme Mapping	321	155	NEC Computer Systems	82-83	242	UMAX Technology	213
*	Diamond Multimedia Systems	207	153	NEC Computer Systems	175	241	UMAX Technology	215
*	Digital Equipment Corp.	41	157	NEC Technologies	114-115	345	Value America	70-71
232	ELSA, Inc.	190	301	Network Associates	161	298	ViewSonic	84
004	Epson America	12-13	299	Network Associates	163	*	Visio	117
099	Gateway 2000	36A-37	202	Newcom	188-189	206	Web Communications	244
104	Gateway 2000	105-111	*	Nokia	72	085	Winbook	325
143	Hitachi PC Corporation	62-63	118	Optiquest	219	*	Xircom	96
*	Hewlett Packard	32-33	*	Oracle Corp.	11	*No Infolink#. Please Call Advertiser For More Information.		
*	IBM Corporation	125A-B	209	Panda Software	234			

Infolink No.	Company	Product	Page	Infolink No.	Company	Product	Page
ACCELERATOR BOARDS				FAX SOFTWARE			
232	Diamond Multimedia Systems	Stealth II	207	134	01 Communique Laboratory Inc.	Communicate!	252
232	ELSA, Inc.	3D Graphics Accelerators	190	FAX/MODEM			
232	Intel Corporation	Processors	66-67	202	Newcom	V 90 Modem	188-189
ADD-ON BOARDS				FLOWCHARTING SOFTWARE			
101	ATI Technologies	All-In-Wonder Pro	203	•	Visio	Visio Product Lines	117
212	AOpen Inc.	Motherboard	262	GRAPHICS SOFTWARE			
ANTI-VIRUS SOFTWARE				•	Adobe Systems Inc.	Adobe Photoshop	69
209	Panda Software	24h-365d Antivirus Insurance	234	011	Corel Corporation	Word Perfect 8	257
•	Symantec Corporation	Norton AntiVirus	131	194	Macromedia	FreeHand 8	259
•	Symantec Corporation	Anti-Virus & Utilities Software	248	•	Visio	Visio Product Lines	117
BACKUP SOFTWARE				HAND-HELD PC'S			
342	American Power Conversion	Back-UPS Line	25	•	Microsoft	Palm Pilot	134
BRIDGES/ROUTERS/GATEWAYS				HARD DRIVES			
333	D-Link Systems	Switches	224	161	AIWA America	Travan Tape Drive	323
033	SMC	EZline & Tigerline	242	•	CompUSA PC	CompUSA PC	92
CAD/CAM				019	L.A. Trade	Memory, Hard Drives, PCMCIA	292
•	Autodesk Inc.	AutoCAD LT	50	014	Paragon Memory	Infinity	284
CD-ROM				176	PowerQuest Corp.	Guardian Angel	8
•	Adaptec	CD-Recordable	318	315	Syquest Technology	Syquest Sparq	95
191	Mendian Data	CD Networking	241	HARDWARE			
284	Smart and Friendly	CD Rocket	332	•	3 Com Corporation	SuperStack	238
CHIPS/PROCESSORS				030	A.T. Cross Company	Cross I Pen	77
106	Kingston Technology Corporation	Memory	20	087	Acer America	TravelMate	169
229	Silicon Integrated Systems	3D Chip	265	092	Acer America	Notebook Family	205
COMMUNICATIONS SOFTWARE				•	Adaptec	CD-Recordable	318
134	01 Communique Laboratory Inc.	Communicate!	252	161	AIWA America	Travan Tape Drive	323
374	Seagate Software NSMG	Seagate Software-NSMG	233	•	CompUSA PC	CompUSA PC	92
COMPUTERS/COMPATIBLES				203	Crucial Technology	Micron Memory Upgrades	34
087	Acer America	TravelMate	169	•	Dell Computer Corporation	Notebooks, Dimension & Servers	C5-C8
092	Acer America	Notebook Family	205	•	Dell Computer Corporation	Servers	171
•	Compaq Computer Corporation	Compaq Computer Corporation	74-75	•	Dell Computer Corporation	Dimension	196-197
•	CompUSA PC	CompUSA PC	92	•	Dell Computer Corporation	Dimension, Notebooks, Servers	22-23
360	COMPUTER DISCOUNT WAREHOUSE	Hardware	165	•	Dell Computer Corporation	Notebook Computers	90-91
159	COMPUTER DISCOUNT WAREHOUSE	Hardware	166-167	•	Digital Equipment Corp.	Digital Equipment Corporation	41
158	COMPUTER DISCOUNT WAREHOUSE	Hardware	285	104	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	105-111
109	COMPUTER DISCOUNT WAREHOUSE	Hardware	286-287	099	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	36A-37
•	Dell Computer Corporation	Notebooks, Dimension & Servers	C5-C8	•	Hewlett Packard	HP Commercial PC	32-33
•	Dell Computer Corporation	Servers	171	•	IBM Corporation	IBM ThinkPad	148-149
•	Dell Computer Corporation	Dimension	196-197	295	J&R Computer World	Systems, Hardware, Peripherals	282-283
•	Dell Computer Corporation	Dimension, Notebooks, Servers	22-23	003	Micro Warehouse	Hardware, Software, Systems	290-291
•	Dell Computer Corporation	Notebook Computers	90-91	119	Micron Electronics	Micron Family of Products	139-142
•	Digital Equipment Corp.	Digital Equipment Corporation	41	098	Micron Electronics	Transport	16-17
104	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	105-111	013	Micron Electronics	Micron Family of Products	181-187
099	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	36A-37	120	Micron Electronics	Micron Family of Products	48A-49
•	Hewlett Packard	HP Commercial PC	32-33	221	Mita Copystar	Mita AI-3030 Digital Copier Printer	261
•	IBM Corporation	IBM ThinkPad	148-149	•	Mitsubishi Electronics	Monitors	123
295	J&R Computer World	Systems, Hardware, Peripherals	282-283	202	Newcom	V 90 Modem	188-189
003	Micro Warehouse	Hardware, Software, Systems	290-291	118	Optique	V-Series Monitor	219
119	Micron Electronics	Micron Family of Products	139-142	014	Paragon Memory	Infinity	284
098	Micron Electronics	Transport	16-17	330	PC Mail	Hardware, Software, Peripherals	278-279
013	Micron Electronics	Micron Family of Products	181-187	080	PC Power & Cooling Systems	Power Protection/Cooling Devices	88
120	Micron Electronics	Micron Family of Products	48A-49	068	PC Zone	Mail Order	277
153	NEC Computer Systems	Mobile Pro	175	032	Philips Electronics	USB Digital Speakers	326
156	NEC Computer Systems	NEC NOW	2-3	287	ProGen	Desktops and Notebooks	98-99
154	NEC Computer Systems	NEC NOW	80-81	024	QMS	Magicolor 2	235
155	NEC Computer Systems	NEC NOW	82-83	205	Ricoh Corporation	Ricoh Aficio Color Copiers	124
047	PC Connection	PCs, Peripherals, Software	288-289	309	S.A.G./Storage Solutions	Servers and Storage	243
330	PC Mail	Hardware, Software, Peripherals	278-279	335	Sun Microsystems	Ultra-5 WorkStation	113
068	PC Zone	Mail Order	277	023	Sun Microsystems	Sun Workgroup Server	5
287	ProGen	Desktops and Notebooks	98-99	315	Syquest Technology	Syquest Sparq	95
074	Quantex	Quantex Systems	119-121	066	TigerDirect	Systems	333
309	S.A.G./Storage Solutions	Servers and Storage	243	377	Toshiba	Desktop	144-145
066	TigerDirect	Systems	333	378	Toshiba	Notebook Computers	26-27
377	Toshiba	Desktop	144-145	298	ViewSonic	PS790/GS771 Monitors	84
085	Winbook	Winbook 233 MHz Trilamook	325	ILLUSTRATION			
DATA BASE MANAGERS				•	3 Com Corporation	SuperStack	238
348	Computer Associates	Lan Based Inoculan Desktop	247	333	D-Link Systems	Switches	224
•	Oracle Corp.	Applications	11	•	Intel Corporation	Intel InBusiness	229
DATA CARTRIDGES				•	Intel Corporation	Adapter Servers	63
014	Paragon Memory	Infinity	284	033	SMC	EZline & Tigerline	242
DISK BACKUP & TAPE DRIVES				IMAGE EDITING SOFTWARE			
•	CompUSA PC	CompUSA PC	92	•	Adobe Systems Inc.	Adobe Photoshop	69
027	Micro Solutions Computer Products	Backpack Bantam CD-ROM	293	INTERNET			
DISPLAY PANELS/PROJECTORS				134	01 Communique Laboratory Inc.	Communicate!	252
390	In Focus Systems	DLP Projector	78	133	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
•	Texas Instruments	DLP Projector	155-157	•	IBM Corporation	E Business	125A-B
EDUCATIONAL SOFTWARE				202	Newcom	V 90 Modem	188-189
011	Corel Corporation	Word Perfect 8	257	KEYBOARDS			
ELECTRONIC MAIL				•	CompUSA PC	CompUSA PC	92
206	Web Communications	WebCom Internet Services	244	LAN ADAPTER BOARDS			
ENTERTAINMENT SOFTWARE				•	Xircom	PC Card	96
011	Corel Corporation	Word Perfect 8	257				

Infolink No.	Company	Product	Page
LAPTOP/PORTABLE COMPUTERS			
087	Acer America	TravelMate	189
092	Acer America	Notebook Family	205
380	COMPUTER DISCOUNT WAREHOUSE	Laptops	165
159	COMPUTER DISCOUNT WAREHOUSE	Laptops	166-167
158	COMPUTER DISCOUNT WAREHOUSE	Laptops	285
109	COMPUTER DISCOUNT WAREHOUSE	Laptops	286-287
	Dell Computer Corporation	Notebooks, Dimension & Servers	C5-C8
	Dell Computer Corporation	Notebook Computers	90-91
104	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	105-111
099	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	36A-37
143	Hitachi PC Corporation	VisionBook Pro	62-63
	IBM Corporation	IBM ThinkPad	148-149
295	J&R Computer World	Systems, Hardware, Peripherals	282-283
003	Micro Warehouse	Hardware, Software, Systems	290-291
119	Micron Electronics	Micron Family of Products	139-142
013	Micron Electronics	Micron Family of Products	181-187
120	Micron Electronics	Micron Family of Products	48A-49
153	NEC Computer Systems	Mobile Pro	175
156	NEC Computer Systems	NEC NOW	2-3
154	NEC Computer Systems	NEC NOW	80-81
155	NEC Computer Systems	NEC NOW	82-83
330	PC Mail	Hardware, Software, Peripherals	278-279
068	PC Zone	Mail Order	277
287	ProGen	Desktops and Notebooks	98-99
378	Toshiba	Notebook Computers	26-27
085	Winbook	Winbook 233 MHz Tillamook	325
LOCAL AREA NETWORKING			
	3 Com Corporation	SuperStack	238
348	Computer Associates	Lan Based Inoculan Desktop	247
360	COMPUTER DISCOUNT WAREHOUSE	Networking Products	165
159	COMPUTER DISCOUNT WAREHOUSE	Networking Products	166-167
158	COMPUTER DISCOUNT WAREHOUSE	Networking Products	285
109	COMPUTER DISCOUNT WAREHOUSE	Networking Products	286-287
051	Data Comm Warehouse	Networking Products	249
	Intel Corporation	Intel InBusiness	229
	Intel Corporation	Adapter Servers	53
024	QMS	Magicolor 2	235
374	Seagate Software NSMG	Seagate Software-NSMG	233
MAIL ORDER			
	CompUSA PC	CompUSA PC	92
360	COMPUTER DISCOUNT WAREHOUSE	Reseller	165
159	COMPUTER DISCOUNT WAREHOUSE	Reseller	166-167
158	COMPUTER DISCOUNT WAREHOUSE	Reseller	285
109	COMPUTER DISCOUNT WAREHOUSE	Reseller	286-287
051	Data Comm Warehouse	Networking Products	249
104	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	105-111
099	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	36A-37
279	Insight	Insight Mail Order	220
295	J&R Computer World	Systems, Hardware, Peripherals	282-283
019	L.A. Trade	Memory, Hard Drives, PCMCIA	292
047	PC Connection	PCs, Peripherals, Software	288-289
330	PC Mail	Hardware, Software, Peripherals	278-279
068	PC Zone	Mail Order	277
074	Quantex	Quantex Systems	119-121
066	TigerDirect	Systems	333
085	Winbook	Winbook 233 MHz Tillamook	325
MAPPING SOFTWARE			
022	Delorme Mapping	Delorme Tripmate GPS Receiver	321
MASS STORAGE			
161	AWA America	Travan Tape Drive	323
027	Micro Solutions Computer Products	Backpack Bantam CD-ROM	293
284	Smart and Friendly	CD Rocket	332
MEMORY			
	CompUSA PC	CompUSA PC	92
203	Crucial Technology	Micron Memory Upgrades	34
106	Kingston Technology Corporation	Memory	20
019	L.A. Trade	Memory, Hard Drives, PCMCIA	292
MISCELLANEOUS			
	Andro Corporation	Computer Furniture	94
032	Philips Electronics	USB Digital Speakers	326
293	Play Inc.	Snappy	57
242	UMAX Technology	Corporate Branding	213
MODEMS			
	3 Com Corporation	56K Modem	54-55
133	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
153	NEC Computer Systems	Mobile Pro	175
158	NEC Computer Systems	NEC NOW	2-3
154	NEC Computer Systems	NEC NOW	80-81
155	NEC Computer Systems	NEC NOW	82-83
202	Newcom	V90 Modem	188-189
	Xircor	PC Card	96
MONITORS			
	CompUSA PC	CompUSA PC	92
084	Iiyama North America	Monitors	44
184	Iiyama Direct	Monitors	86
387	LG Electronics USA	Monitors	153
039	MAG InnoVision	Monitors	18-19
	Mitsubishi Electronics	Monitors	123
153	NEC Computer Systems	Mobile Pro	175
158	NEC Computer Systems	NEC NOW	2-3
154	NEC Computer Systems	NEC NOW	80-81
155	NEC Computer Systems	NEC NOW	82-83
157	NEC Technologies	A&E Monitors	114-115

Infolink No.	Company	Product	Page
	Nokia	Monitors	72
118	Optquest	V-Series Monitor	219
151	Philips Electronics	Monitors	65
227	Shamrock Technology Co., Ltd	Monitors	270
298	ViewSonic	PS790/GS771 Monitors	84
MULTIMEDIA HARDWARE			
101	ATI Technologies	All-in-Wonder Pro	203
	CompUSA PC	CompUSA PC	92
	Diamond Multimedia Systems	Stealth II	207
027	Micro Solutions Computer Products	Backpack Bantam CD-ROM	293
202	Newcom	V90 Modem	188-189
MULTIMEDIA SOFTWARE			
011	Corel Corporation	Word Perfect 8	257
022	Delorme Mapping	Delorme Tripmate GPS Receiver	321
NETWORK INTERFACE CARDS			
133	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
033	SMC	EZline & Tigerline	242
	Xircor	PC Card	96
NETWORK SYSTEMS/EQUIPMENT			
133	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
333	D-link Systems	Switches	224
051	Data Comm Warehouse	Networking Products	249
	Dell Computer Corporation	Servers	171
191	Meridian Data	CD Networking	241
073	South Hills Datacomm	Networking Products	237
NETWORKING SOFTWARE			
133	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
301	Network Associates	Software	161
299	Network Associates	Software	153
	Symantec Corporation	Norton AntiVirus	131
	Symantec Corporation	Anti-Virus & Utilities Software	248
ON LINE SERVICES			
	IBM Corporation	E-Business	125A-B
345	Value America	Online Services	70-71
ORGANIZATIONAL SOFTWARE			
	Microsoft	Microsoft Office 97	C2-C4,p1
PC ACCESSORIES			
030	A.T. Cross Company	Cross I Pen	77
164	Micron Electronics	Additions	15
PC DIRECT			
158	COMPUTER DISCOUNT WAREHOUSE	Reseller	285
109	COMPUTER DISCOUNT WAREHOUSE	Reseller	286-287
295	J&R Computer World	Systems, Hardware, Peripherals	282-283
019	L.A. Trade	Memory, Hard Drives, PCMCIA	292
027	Micro Solutions Computer Products	Backpack Bantam CD-ROM	293
003	Micro Warehouse	Hardware, Software, Systems	290-291
014	Paragon Memory	Infinity	284
047	PC Connection	PCs, Peripherals, Software	288-289
330	PC Mail	Hardware, Software, Peripherals	278-279
068	PC Zone	Mail Order	277
PCMCIA			
019	L.A. Trade	Memory, Hard Drives PCMCIA	292
	Xircor	PC Card	96
PERIPHERALS			
030	A.T. Cross Company	Cross I Pen	77
	CompUSA PC	CompUSA PC	92
004	Epson America	Epson Printer	12-13
104	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	105
099	Gateway 2000	Notebooks, PCs, Mail Order, Peripherals	36A-37
	Intel Corporation	Intel InBusiness	229
	Intel Corporation	Adapter Servers	53
295	J&R Computer World	Systems, Hardware, Peripherals	282-283
094	Lexmark International Inc	Lexmark Printers	31
221	Mita Copystar	Mita AI-3030 Digital Copier Printer	261
202	Newcom	V90 Modem	188-189
047	PC Connection	PCs, Peripherals, Software	288-289
330	PC Mail	Hardware, Software, Peripherals	278-279
024	QMS	Magicolor 2	235
	Texas Instruments	DLP Projector	155-157
	Xircor	PC Card	96
POWER PROTECTION			
342	American Power Conversion	Back-UPS Line	25
080	PC Power & Cooling Systems	Power Protection/Cooling Devices	88
PRINTER ACCESSORIES			
024	QMS	Magicolor 2	235
127	Ringdate	Print Server	236
PRINTERS			
004	Epson America	Epson Printer	12-13
094	Lexmark International Inc	Lexmark Printers	31
221	Mita Copystar	Mita AI-3030 Digital Copier Printer	261
024	QMS	Magicolor 2	235
205	Ricoh Corporation	Ricoh Aficio Color Copiers	124
PROGRAM DEVELOPERS			
	Microsoft	IPT Internet Platform	58-59

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- Micro Warehouse
- Nebraska Furniture Mart
- PC Connection
- T-Zone

Choose 284 at www.pcmag.com/infolink

ADVERTISERS' INDEX

Infolink No	Company	Product	Page
PROGRAMMERS TOOLS UTILITIES			
176	PowerQuest Corp.	Guardian Angel	8
PROJECT MANAGEMENT SOFTWARE			
148	Primavera	Sure Trak Project Management Software	208
REMOTE COMPUTING			
315	Syquest Technology	Syquest Sparq	95
SCANNERS			
241	UMAX Technology	Scanner	215
SERVERS			
*	Dell Computer Corporation	Notebooks, Dimension & Servers	C5-C8
*	Dell Computer Corporation	Servers	171
*	Dimension	Dimension	196-197
*	Dell Computer Corporation	Dimension, Notebooks, Servers	22-23
119	Micron Electronics	Micron Family of Products	138-142
096	Micron Electronics	Transport	18-17
013	Micron Electronics	Micron Family of Products	181-187
120	Micron Electronics	Micron Family of Products	48A-49
153	NEC Computer Systems	Mobile Pro	175
156	NEC Computer Systems	NEC NOW	2-3
154	NEC Computer Systems	NEC NOW	80-81
155	NEC Computer Systems	NEC NOW	82-83
127	Ringdale	Print Server	236
309	S.A.G./Storage Solutions	Servers and Storage	243
023	Sun Microsystems	Sun Workgroup Server	5
SOFTWARE			
134	DT Communic Laboratory Inc.	Communicate!	252
*	Adobe Systems Inc.	Adobe Photoshop	89
*	Advanced Recognition Technologies	smARTwriter/smARTCommand	14
171	Innovative Software	Ghost Software	38
194	Macromedia	FreeHand 8	259
003	Micro Warehouse	Hardware, Software, Systems	290-291
*	Microsoft	Microsoft Office 97	C2-C4,p1
*	Microsoft	Microsoft Office 97	1
301	Network Associates	Software	161
299	Network Associates	Software	163
*	Oracle Corp.	Applications	11
209	Panda Software	24h-365d Antivirus Insurance	234
047	PC Connection	PCs, Peripherals, Software	288-289
330	PC Mall	Hardware, Software, Peripherals	278-279
176	PowerQuest Corp.	Guardian Angel	8
148	Primavera	Sure Trak Project Management Software	208
*	Symantec Corporation	Norton AntiVirus	131
*	Symantec Corporation	Anti-Virus & Utilities Software	248
*	Visio	Visio Product Lines	117
STATISTICAL SOFTWARE			
057	Statsoft	Statistical Software	43
UTILITIES			
171	Innovative Software	Ghost Software	38
301	Network Associates	Software	161
299	Network Associates	Software	163
176	PowerQuest Corp.	Guardian Angel	8
*	Symantec Corporation	Norton AntiVirus	131
*	Symantec Corporation	Anti-Virus & Utilities Software	248
VIDEO GRAPHICS/BOARDS			
*	Diamond Multimedia Systems	Stealth II	207
381	Matrox Graphics Inc.	Productiva G100	200-201
VOICE RECOGNITION SOFTWARE			
*	Advanced Recognition Technologies	smARTwriter/smARTCommand	14
WEB SOFTWARE			
194	Macromedia	FreeHand 8	259
206	Web Communications	WebCom Internet Services	244
WEB/INTERNET SERVICES			
*	IBM Corporation	E-Business	125A-B
206	Web Communications	WebCom Internet Services	244
WINDOWS SOFTWARE			
*	Adobe Systems Inc.	Adobe Photoshop	89
348	Computer Associates	Lan Based Inoculen Desktop	247
*	Microsoft	Microsoft Office 97	C2-C4,p1
176	PowerQuest Corp.	Guardian Angel	8
057	Statsoft	Statistical Software	43
*	Symantec Corporation	Norton AntiVirus	131
*	Symantec Corporation	Anti-Virus & Utilities Software	248
*	Visio	Visio Product Lines	117
WORK GROUP SOFTWARE			
023	Sun Microsystems	Sun Workgroup Server	5
WORKSTATIONS			
335	Sun Microsystems	Ultra-5 WorkStation	113

For Additional Categories see MARKETPLACE PRODUCT INDEX PAGE 294.

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Abort, Retry, Fail?

5-day forecast:

last updated 6:05 am EST

BAD CITY	BAD CITY	BAD CITY	BAD CITY	BAD CITY
BAD CITY	BAD CITY	BAD CITY	BAD CITY	BAD CITY
BAD CITY	BAD CITY	BAD CITY	BAD CITY	BAD CITY
BAD CITY	BAD CITY	BAD CITY	BAD CITY	BAD CITY

On March 20, The Weather Channel Online presented this five-day forecast for Toledo, Ohio.

Is It Safe to Proceed?

Spotted online at Magellan: "Green Light Sites Only: Use this option for a high-quality, targeted search of reviewed sites that, at the time of review, contained no content intended for mature audiences."

BRITANNICA online

SINCE 1768

But you didn't know the Brits had such a head start on the Internet. (The Encyclopaedia Britannica Web site.)

New Perspectives on Wealth

Bill Gates's fortune recently surpassed \$50 billion? Do you know how many flaky and delicious Hostess Fruit Pies he could buy from the *PC Magazine* vending machine with all that money? 76.9 billion, that's how many. That's 288 pies for each person in America.



If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or via e-mail to don_willmott@zd.com. Winners this issue: Paul Addison, Jeff Bassett, Gary Garnier, Curtis Hoke, and Tony Vargas.



Moral of the story: Get your Gateway monitor home before midnight or it turns into a pumpkin. (Exton Commons Real Estate ad/Gateway ad.)

Homonym Hell

File this item under "Press Releases We Never Finished Reading": "Following find the latest announcement from V Communications—JUST ANNOUNCED TODAY. Hope you can use it on your online sight."



Conversa's voice-driven, mouse-free navigation system in use.

Actually, that's an asthma inhaler; but hey, it's an easy mistake. (Silicon Valley Tech Week.)

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